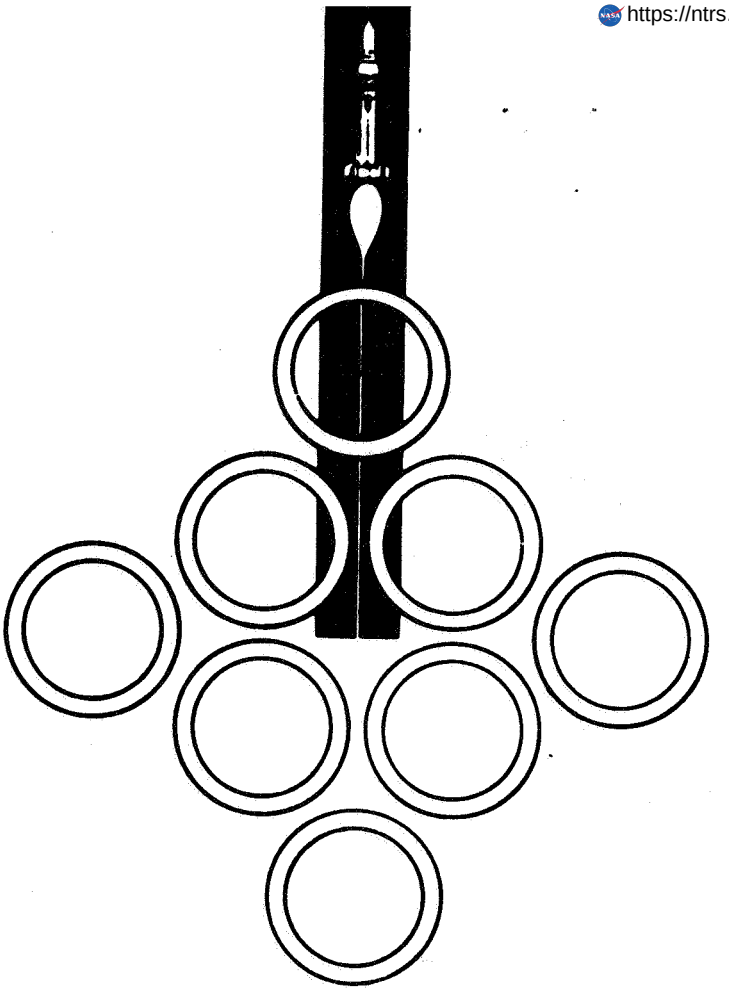


ENGINEERING DEPARTMENT

TR-RE-CCSD-FO-1117-3

May 9, 1968

TEST REPORT

FOR

GLOBE VALVE, 3/4-INCH, 6000 PSIG

Pacific Valve Co. Part Number 3/4-S-17250Y-12K-GL(XXS)

NASA Drawing Number 75M09618 PGLV-3

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

GLOBE VALVE, 3/4-INCH, 6000-PSIG

Pacific Valve Co. Part Number 3/4-S-17250Y-12K-GL(XXS)

NASA Drawing Number 75M09618 PGLV-3

ABSTRACT

This report presents the results of tests performed on one specimen of Globe Valve 75K09618-PGLV-3. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Flow
5. Seat Erosion
6. Surge
7. Low Temperature
8. High Temperature
9. Sand and Dust
10. Salt Fog
11. Seat Erosion (Additional)
12. Cycle
13. Burst

The specimen's performance was in accordance with the specification requirements of NASA Drawing Number 75M09618-PGLV-3 except during the initial functional, cycle and burst test.

During the functional test, leakage was observed around the valve stem when the inlet port of the specimen was pressurized to 100 psig.

The housing eye bolts were tightened to the recommended torque and the leakage ceased.

During cycle 562, the valve would not seat regardless of the amount of torque applied. Disassembly inspection revealed a badly eroded KEL-F seat.

During burst testing, the valve failed at 22,500 psig. The specification requirements were that the valve withstand a minimum burst pressure of 24,000 psig.

The required seating, running and breakaway torque was changed from 10, 10 and 5 ft-lbs to 45, 45 and 10 ft-lbs due to the 10-inch handle. During field operations these torque values are applied.

COMPONENT DATA	NASA DWG/SPEC/CODE NO.	FILE NO.
	75M09618 PGLV-3	GENERIC CODE D361103020013
	FIND NO. A6811	COMPLEX 34
	REF DESIG. NO.	SYSTEM Pneumatic Supply
	PRIORITY IV	
NOMENCLATURE: Y Globe Valve 3/4" 6000 psig	MANUFACTURER: Pacific Valve Co.	SUBSYSTEM: GH_2 Storage
		NHA DWG. NO. 75M09617
CRITICALITY NO.	MFG MODEL NO.	STOCK CODE NO.
CEI NO.	MFG PART NO. 3/4-S-17250Y-12K-GL(XXS)	REVISION: DATE 6/26/68
MAINTENANCE MANUAL	MFG DWG NO.	PREPARING ORGANIZATION: Chrysler Corporation

SPECIFICATION REQUIREMENTS:

Media: GH_2
Operating Pressure: 6000 psig
Proof Pressure: 9000 psig
Burst Pressure: 24,000 psig
Leakage: Internal -Bubble tight @ 6000 psig
External - Bubble tight @ 6000 psig
Seat Erosion: Capable of operation after throttling 6000 psig GH_2 for 4 hours
Flow Capacity: Cv = 3.79 min.
Connections: 3/4 XXS Gayloc Hubs

FUNCTION:

The valve is used as a shutoff valve for venting the high pressure gaseous storage bottles.

ASSESSMENT & RECOMMENDATIONS:

The valve successfully completed all the tests except cycle and burst. The valve soft seat failed by erosion after 561 cycles of the cycle test. At this point the valve had been subjected to 595 cycles, 50 of which had substantial flow. Also it had been subjected to flowing 2 SCFM of GH_2 for 120 hours and 100 SCFM of GN_2 for 4 hours. During the burst test, water leakage occurred at the bonnet gasket at 22,500 psig. This failure was not a catastrophic structural failure.

(Continued on 2 of 2)

TEST HISTORY: Sheet 2 of 2

TEST REPORT NO.	TEST TYPE	REMARKS
TR-RE-CCSD-FO-1117-3	Receiving Inspection	Satisfactory
	Proof Pressure	Satisfactory
	Functional	Satisfactory
	Flow	Cv = 8.9
	Seat Erosion (GH_2)	Satisfactory
	Surge	Satisfactory
	Low Temperature	Satisfactory
	High Temperature	Satisfactory
	Sand & Dust	Satisfactory
	Seat Erosion (GN_2)	Satisfactory
	Cycle	Valve would not seal after 562 cycles
	Burst	Bonnet Gasket ruptured at 22,500 psig

SERVICE HISTORY:

The valve was tested to qualify an alternate source for NASA P/N 75M09618 PGLV-3.

(Continued)

The valve is considered qualified for a cross country 6000 psig shut-off valve. The valve is suitable for mono directional flow (over the plug). It is not capable of fine metering because of the plug design. The valve's soft seat should be visually inspected for damage periodically and replaced as necessary.

TEST REPORT

FOR

GLOBE VALVE, 3/4-INCH, 6000 PSIG

Pacific Valve Co, Part Number 3/4-S-17250Y-12K-GL(XXS)

NASA Drawing Number 75M09618 PGLV-3

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

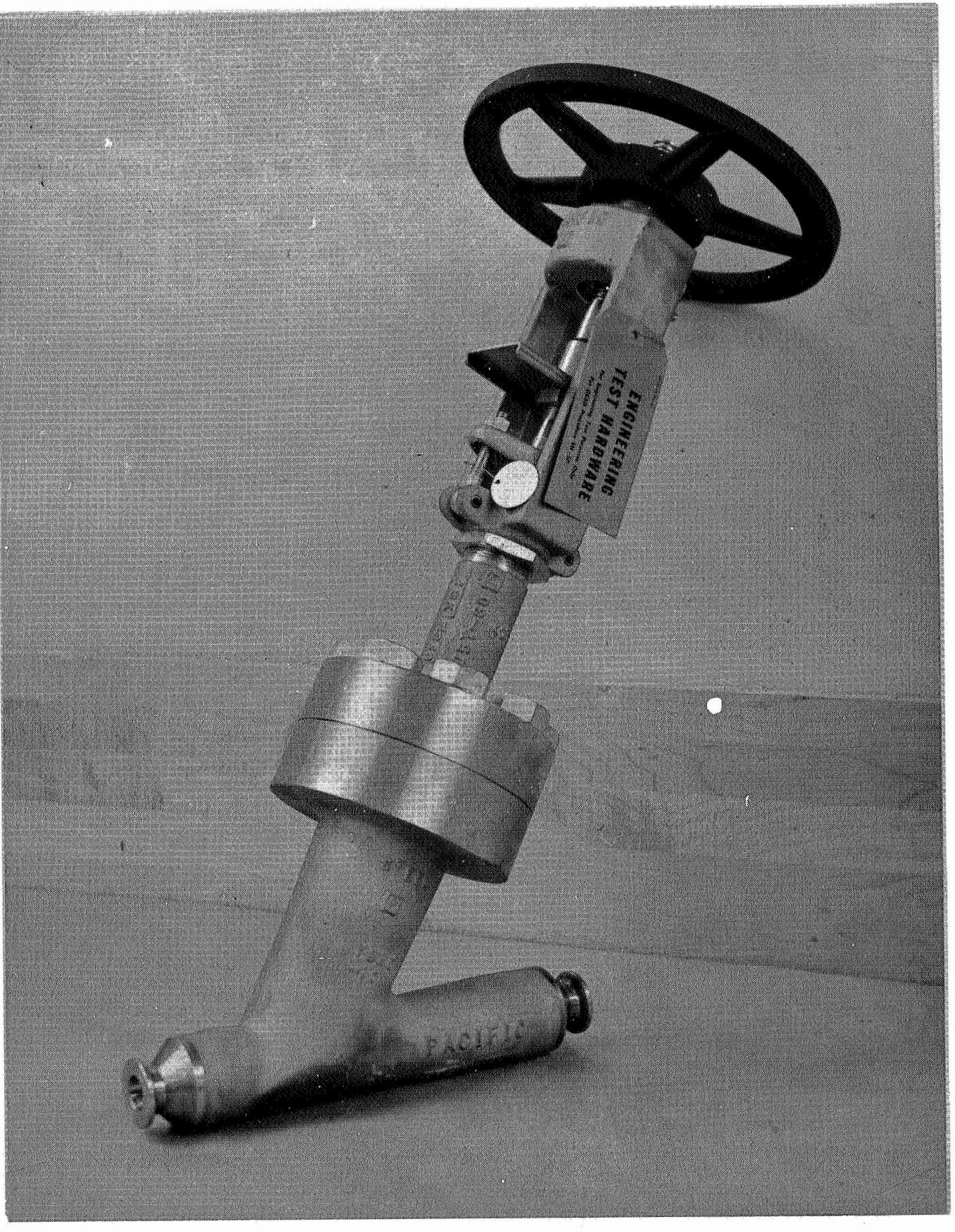
The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

LIST OF TABLES (CONTINUED)



Globe Valve 75M09618 PGLV-3

CHECK SHEET

FOR

GLOBE VALVE, 3/4-INCH, 6000 PSIG

MANUFACTURER: Pacific Valve Company
MANUFACTURER'S MODEL NUMBER: 3/4-S-17250Y-12K-GL(XXS)
NASA DRAWING NUMBER: 75M09618 PGLV-3
TEST AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIUM:	GH_2
B.	OPERATING PRESSURE:	6000 psig
C.	PROOF PRESSURE:	9000 psig
D.	BURST PRESSURE:	24,000 psig
E.	VALVE CAPACITY (C_v):	8.9
F.	TORQUE - Valve stem maximum:	
	Breakaway	10 ft-lb maximum with 6000 psig above seat
	Running	5 ft-lb maximum
	Seating	10 ft-lb maximum against 6000 psig

II. CONSTRUCTION

A.	BODY MATERIAL:	316 stainless steel passivated per paragraph 5.4.1 of MIL-STD-171
B.	SEAT MATERIAL:	KEL-F
C.	BACKUP RING MATERIAL:	Teflon
D.	CONTROL KNOB MATERIAL:	Aluminum
E.	PACKING MATERIAL:	Teflon
F.	CONNECTIONS:	3/4 Inch XXS Grayloc fittings
G.	SECTIONAL DIMENSIONS:	See Drawing 75M09618

III. ENVIRONMENTAL REQUIREMENTS

OPERATING TEMPERATURE: -20 to 160°F

IV. LOCATION AND USE

Used in the pneumatic system of Saturn IB ground support equipment at Launch Complex 34.

TEST SUMMARY

GLOBE VALVE, 3/4-INCH, 6000 PSIG

75M09618 PGLV-3

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	1	Specifications and Drawings	Conformance to specifications and drawings	Satis-factory	
Proof Pressure Test	1	9000 psig	Check for leakage and distortion	Satis-factory	No leakage or distortion
Functional Test	1	6000 psig Torque require-ments: Breakaway: 10 ft-lbs; Running: 45 ft-lbs; Seating: 45 ft-lbs	Check seat leakage torque values	Satis-factory	Specimen leaked with inlet port pressurized to 100 psig but was satis-factory when the eye bolt nuts were tor-qued to 10 inch-lb
Flow Test	1		Determine C_v	Satis-factory	Maximum C_v was found to be 9.5 at a flow rate of 18 gpm
Seat Erosion Test	1	100 SCFM of GN_2 at 6000 psig inlet with out-let below 50 psig for 4 hours	Determine if the environment causes degradation or deformation	Satis-factory	No leakage or distortion
Surge Test	1	0 to 6000 psig in 100 milli-seconds. 10 cycles with valve closed, and 10 cycles with valve partially open	Determine if speci-men operation is impaired by surge	Satis-factory	No leakage or distortion
Low Temperature Test	1	-20 (+0, -4)°F	Determine if speci-men operation is impaired by low temperature	Satis-factory	No leakage or distortion

TEST SUMMARY (CONTINUED)

GLOBE VALVE, 3/4-INCH, 6000 PSIG

75M09618 PGLV-3

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
High Temperature Test	1	+160 (+4,-0)°F	Determine if specimen operation is impaired by high temperature	Satisfactory	No leakage or distortion
Sand and Dust Test	1	Subjected for 2 hours at 77°F and 2 hours at 160°F	Determine if the specimen is impaired by the environmental change	Satisfactory	No leakage or distortion
Salt Fog Test	1	240 ($\pm$2) hours	Determine if specimen is impaired by environmental change	Satisfactory	No leakage or distortion
Seat Erosion Test	1	100 SCFM of GN_2 maintained for 4 hours	Determine if the environment causes degradation or deformation	Satisfactory	No leakage or distortion
Cycle Test	1	1000 cycles with 6000 psig on inlet of specimen	Determine if specimen is impaired by cycling	Unsatisfactory	Seat failed during cycle 562
Burst Test	1	Minimum of 24,000 psig for 5 minutes	Check for structural damage and leakage at minimum burst pressure	Unsatisfactory	The bonnet gasket ruptured at 22,500 psig

SECTION I

INTRODUCTION

1.1 SCOPE

1.1.1 This report describes the tests of Globe Valve 75M09618 PGLV-3. Tests included were those necessary to determine whether the valve will satisfy the operational and environmental requirements of the John F. Kennedy Space Center. A summary of the test results is presented on pages viii and ix.

1.1.2 One specimen was tested.

1.2 ITEM DESCRIPTION

1.2.1 Globe Valve 75M09618 PGLV-3 has a 3/4-inch nominal size inlet port. It has a design operating pressure of 6000 psig and is rated for use with GH_2.

1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Globe Valve 75M09618 PGLV-3:

a. KSC-STD-164(D), Standard Environmental Test Methods for Ground Support Equipment Installations at Cape Kennedy

b. Component Specification 75M09618 PGLV-3

c. Cleanliness Standard A1OM10671

d. Test Plan CCSD-FO-1117-1F

e. Test Procedure CCSD-FO-1117-2F

SECTION II

RECEIVING INSPECTION

2.1 REQUIREMENTS

The test specimen shall be visually and dimensionally inspected for conformance with NASA drawing 75M09618 PGLV-3 and applicable specifications. Inspection shall not include disassembly of the specimen.

2.2 PROCEDURE

A visual and dimensional inspection was performed to determine compliance with NASA drawing 75M09618 PGLV-3 and applicable vendor drawings to the extent possible without disassembling the test specimen. Inspections were also made for poor workmanship and manufacturing defects. Equipment used in the inspections is listed in table 2-1.

2.3 TEST RESULTS

The specimen complied with NASA drawing 75M09618 PGLV-3. No evidence of poor workmanship or other manufacturing defects was observed.

2.4 TEST DATA

The data presented in table 2-2 were recorded during the inspection.

Table 2-1. Receiving Inspection Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Cal. Date
1	Steel Scale	Brown & Sharpe	300	NASA 101-1013	7-23-64

Table 2-2. Receiving Inspection Test Data

Item	Specified Dimensions (inches)	Actual Dimensions (inches)
End to End	12.125	11.75
to Top	23.50	23.25
Handwheel Diameter	10.00	10.00
End to Int	3.875	4.25
End to Top	20.375	20.50

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 The test specimen shall be subjected to a proof pressure of 9000 psig.

3.1.2 The pressure shall be simultaneously applied to the inlet and outlet ports with the valve in the open position, and shall be maintained for 5 minutes.

3.1.3 The specimen shall be inspected for leakage and distortion.

3.2 TEST PROCEDURE

3.2.1 The test specimen was installed in the test setup as shown in figures 3-1 and 3-2 utilizing the equipment listed in table 3-1.

3.2.2 Hand valve 7 and regulator 21 were closed.

3.2.3 The test specimen and hand valves 5, 6, 8, 9, 10 and 11 were opened and the system was filled with de-ionized water.

3.2.4 Hand valves 5, 8, 9 and 11 were closed.

3.2.5 Hand valve 7 was opened, and 3000 psig GN_2 was monitored on gage 14.

3.2.6 Regulator 21 was adjusted until a pressure of between 50 and 100 psig was indicated on gage 15.

3.2.7 Switch 17 was then closed. Solenoid valve 18 opened, and pump 19 started operating.

3.2.8 The pump continued to operate until a pressure of 9000 psig was indicated on gage 3. Switch 17 was then opened to stop pumping.

3.2.9 The 9000 psig pressure was maintained for 5 minutes, and the specimen was checked for leakage.

3.2.10 Hand valves 9 and 11 were opened to vent the system, and the specimen was then checked for distortion.

3.2.11 All data were recorded.

3.3 TEST RESULTS

The specimen did not leak and there was no evidence of distortion.

3.4 TEST DATA

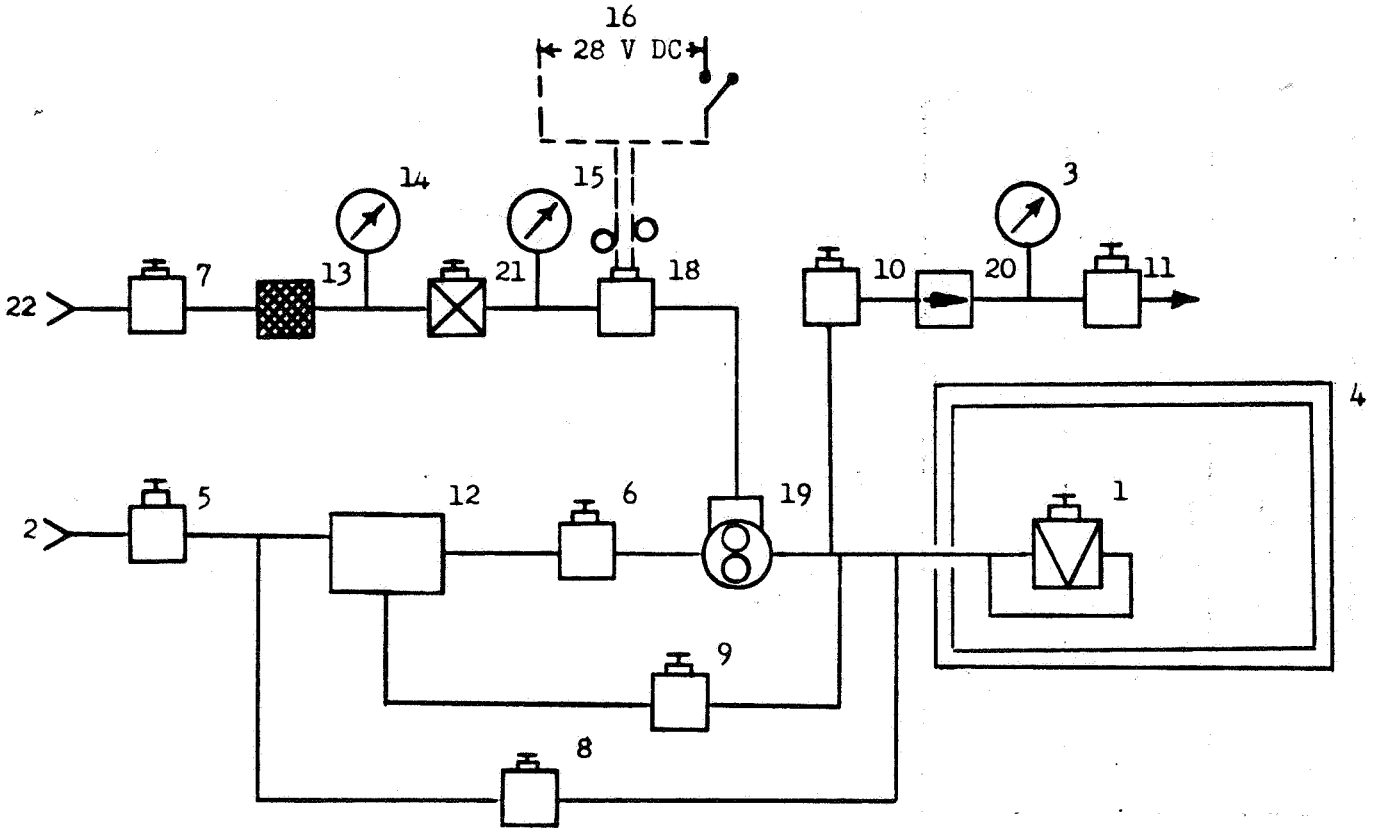
The test data presented in table 3-2 were recorded during the test.

Table 3-1. Proof Pressure and Burst Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Pacific Valve Co.	3/4-S-172 50Y-12K-G L(XXS)	NASA 75M09618 PGLV-3	3/4-inch globe valve
2	Water Supply	CCSD	NA	NA	Deionized
3	Hydrostatic Pressure Gage	Astra	NA	NASA 011893	0-to 100,000 psig ±2.0% FS Cal. date 11-2-66
4	Burst Chamber	CCSD	NA	NASA 201344	3 ft x 3 ft x 3 ft
5	Hand Valve	Aminco	50011A	NA	1/4-in.
6	Hand Valve	Aminco	50011A	NA	1/4-in.
7	Hand Valve	Aminco	50011A	NA	1/4-in.
8	Hand Valve	Aminco	50011A	NA	1/4-in.
9	Hand Valve	Aminco	50011A	NA	1/4-in.
10	Hand Valve	Aminco	50011A	NA	1/4-in.
11	Hand Valve	Aminco	50011A	NA	1/4-in.
12	Water Reservoir	CCSD	NA	NA	2-gal.
13	Pneumatic Filter	Bendix Corp.	1731260	NA	2-micron
14	Pressure Gage	Ashcroft	10575	NA	0-to 5000-psig ±2% FS
15	Pressure Gage	Ashcroft	8990	NA	0-to 300-psig ±2% FS
16	Power Supply	CCSD	NA	NA	28 vdc
17	Switch	Cutler-Hammer	NA	NA	SPST
18	Solenoid Valve	Marotta Valve Co.	207803	NA	2-way normally closed
19	Hydrostatic Pump	Sprague Engr.Corp.	NA	300-16-64	Air operated; maximum pressure 50,000 psig

Table 3-2. Proof Pressure Test Data

Pressure	9000 psig/5 minutes
Leakage	Zero
Distortion	Zero



Note: All lines 1/4-inch
Refer to table 3-1 for item identification.

Figure 3-1. Proof Pressure and Burst Test Schematic

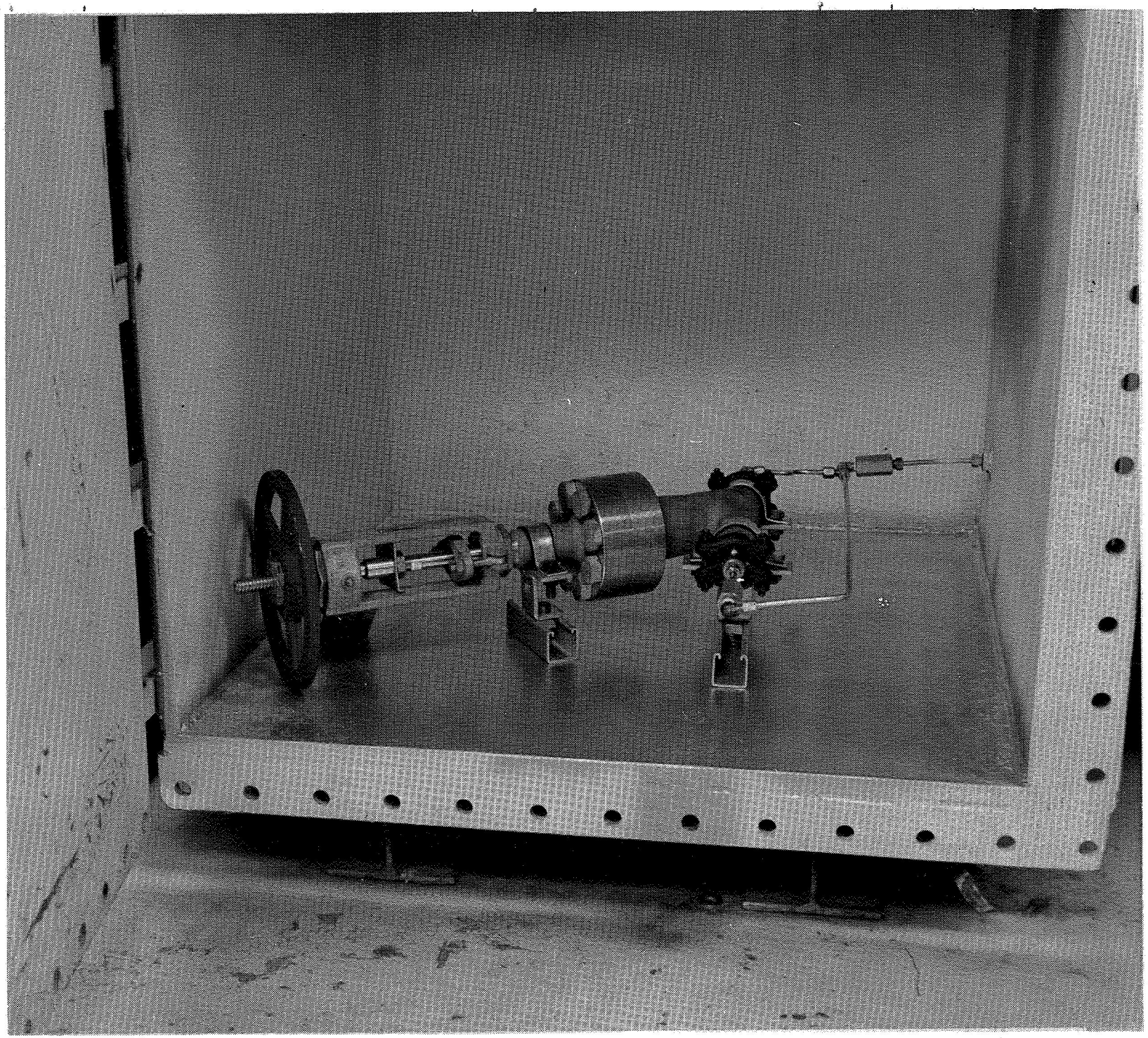


Figure 3-2 Proof Pressure Test Setup

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 The test specimen shall be inspected for leakage with the outlet port of the specimen pressurized to 6000 psig, specimen closed, and the inlet port vented. Leakage shall be recorded.

4.1.2 The test specimen shall be inspected for leakage with the inlet port of the specimen pressurized to 6000 psig, specimen closed, and the outlet port vented. Leakage shall be recorded.

4.1.3 The opening, closing, and normal running torque of the valve shall be determined with the inlet port pressurized to 6000 psig and then relieved to zero psig.

4.1.4 The procedures described in 4.1.1 and 4.1.2 shall be repeated for the initial functional test and performed for all subsequent functional tests. The procedure described in 4.1.3 shall be performed ten times initially and three times for all subsequent functional tests.

4.1.5 All test data shall be recorded.

4.2 TEST PROCEDURE

4.2.1 The test setup was assembled as shown in figures 4-1 and 4-2 using the equipment listed in table 4-1 except for thermocouple 17 and thermal chamber 18. All hand valves were closed. Tubing 20 (port A) was connected to the outlet port of the specimen and tubing (port B) was connected to the inlet port.

4.2.2 The hand wheel of the test specimen was replaced with torque wrench 13 and the test specimen was closed using the maximum seating torque of 45 foot-pounds.

4.2.3 Regulators 6 and 15 were adjusted for zero outlet pressure.

4.2.4 Hand valve 3 was slowly opened, and gage 5 indicated 7000 psig.

4.2.5 Regulator 6 was adjusted to establish 6000 psig, as indicated on pressure gage 7.

4.2.6 Hand valve 10 was opened to determine if any leakage was present by bubble observation in graduated beaker 11.

4.2.7 Regulator 6 was adjusted for zero outlet pressure and hand valve 8 was opened to vent the specimen.

4.2.8 Hand valves 8 and 10 were closed.

4.2.9 Tubing 20 (port A) was connected to the inlet port of the specimen and tubing 21 (port B) was connected to the outlet port.

4.2.10 The procedures described in 4.2.5 through 4.2.8 were repeated.

4.2.11 By adjusting regulator 6, the specimen pressure, as indicated on pressure gage 7, was slowly increased to 6000 psig.

4.2.12 The breakaway torque of the specimen was measured by slowly applying the maximum torque required to unseat the specimen.

4.2.13 After the breakway torque was measured, the specimen was completely opened. The running torque required from breakaway until the specimen fully opened was measured.

4.2.14 The specimen was closed and the closing running torque was measured.

4.2.15 Hand valve 9 was opened and closed to vent the outlet pressure of the specimen. Hand valve 10 was opened.

4.2.16 The specimen was slowly opened until bubbles appeared in graduated beaker 11.

4.2.17 The specimen was slowly closed and the torque required to stop the bubbles in beaker 11 was measured. This was the closing torque for the specimen at operating pressure.

4.2.18 Regulator 6 and hand valve 10 were closed.

4.2.19 Hand valves 8 and 9 were opened and closed to vent the specimen.

4.2.20 The procedures described in 4.2.12 through 4.2.14 were repeated to determine breakaway and running torque values for the unpressurized specimen.

4.2.21 Tubing 20 (port A) was disconnected and capped, and tubing 19 (port C) was connected to the inlet port of the specimen.

4.2.22 Regulator 6 was adjusted to establish 100 psig on pressure gage 7.

4.2.23 Hand valve 14 was opened.

4.2.24 Regulator 15 was slowly adjusted, establishing a 2-psig reading on pressure gage 16.

4.2.25 Hand valve 10 was opened.

4.2.26 The test specimen was slowly opened until bubbles appeared in graduate beaker 11.

4.2.27 The test specimen was slowly closed and the torque required to stop the bubbles was measured. This was the closing torque for the specimen when it was unpressurized.

4.2.28 Regulators 6 and 15 were closed and hand valve 8 was opened to vent the supply pressure.

4.2.29 Hand valves 8, 10 and 14 were closed.

4.2.30 Tubing 19 (port C) was disconnected and port A of tubing 20 was uncapped and connected to the inlet of the specimen.

4.2.31 The test specimen was closed using the maximum seating torque as specified.

4.2.32 The procedures described in 4.2.11 through 4.2.31 were performed ten times and the procedures described in 4.2.1 through 4.2.10 were repeated once for the initial functional test.

4.2.33 For all subsequent tests, the procedures described in 4.2.11 through 4.2.30 were performed three times and 4.2.1 through 4.2.10 were performed once.

4.3 TEST RESULTS

During the first cycle of the functional test with the inlet port pressurized at 100 psig, leakage was observed around the stem. The eye bolts on the flange gland were torqued to the required 10-inch-lbs and the specimen functioned satisfactorily during the remainder of the functional test.

4.4 TEST DATA

Initial functional test data are presented in table 4-2.

Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Pacific Valve Co.	3/4-S-17250Y-12K-GL(XXS)	NASA 75M09618 PGLV-3	3/4-inch globe valve
2	He Source	CCSD	NA	NA	7000-psig
3	Hand Valve	Combination Pump and Valve Co.	380-3	NA	1½-in.
4	Filter	Microporous	4813F-2M	NA	2-micron
5	Pressure Gage	Ashcroft	NA	NASA 200616M	0-to 10,000-psig 1 (±0.2)% FS Cal date 1-25-67
6	Pressure Regulator	Tescom Corp.	26-1002	10Ø2	7000-psig outlet
7	Pressure Gage	Ashcroft	NA	NASA 200616-N	0-to 10,000-psig ±0.25% FS Cal date 11-25-66
8	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	1/4-in.
9	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	1/4-in.
10	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	1/4-in.
11	Graduated Beaker	Pyrex Co.	NA	NA	For leakage measurement
12	Tygon Hose	Tygon	NA	NA	Leakage detector
13	Torque Wrench	Armstrong	SR-100	NASA 95-1318B	Replaces hand wheel of specimen (when required) Cal date 8-7-66
14	Hand Valve	Robbins Aviation	SSKG-250-4T	NA	1/4-in.

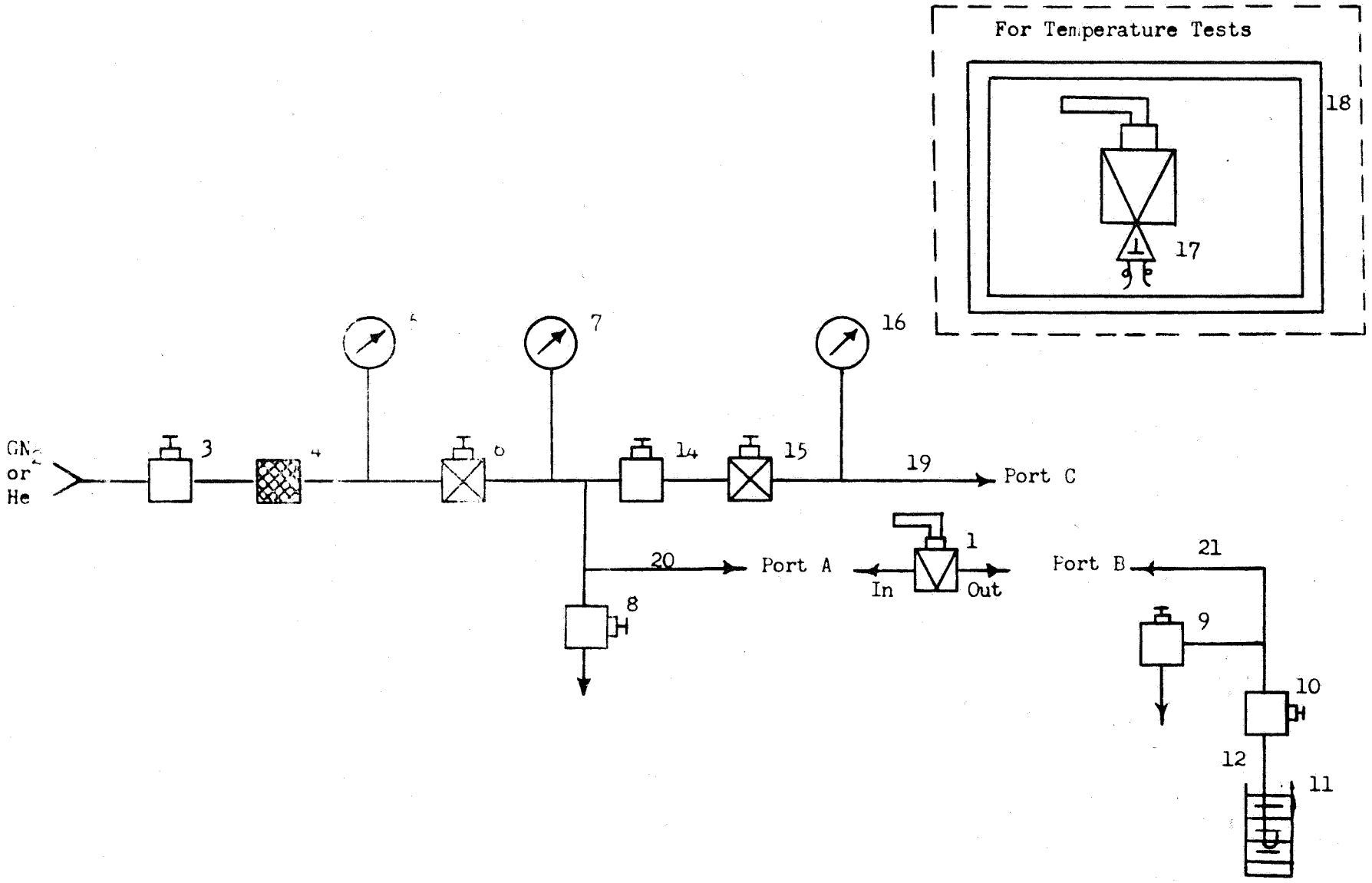
Table 4-1. Functional Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
15	Pressure Regulator	Grave Valve and Regulator Co.	15LXG	L-41524	100-psig inlet 0-to 10-psig
16	Pressure Gage	Marsh Instrument	NA	NASA 08-113-95 1148-B	0-to 30-psig ±0.5% FS Cal date 1-10-67
17	Thermocouple	Honeywell Corp.	30112	NA	-50 to 200(±2.5) °F (temperature tests only)
18	Thermal Chamber	Conrad Corp.	NA	NASA 08-113-2049-41	-30 to 180°F (temperature tests only)
19	S.S. Tubing	Amend	NA	NA	1/4-in. .065 thickness
20	S.S. Tubing	Amend	NA	NA	1/4-in. .065 thickness
21	S.S. Tubing	Amend	NA	NA	1/4-in. .065 thickness

Table 4-2. Initial Functional Test Data After Re-Torquing the Flange Gland

Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque
1	6000	0	None	20 ft-lb
	0	6000	None	45 ft-lb
2	6000	0	None	20 ft-lb
	0	6000	None	45 ft-lb

Run	Specimen Inlet Press. (psig)	Opening Torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	15	10	23	25
	0	2.1	0.08	0.17	—
	2	—	—	—	6.8
2	6000	15	10	25	25
	0	2.9	0.17	0.08	—
	2	—	—	—	5.9
3	6000	15	10	25	27
	0	2.9	0.17	0.17	—
	2	—	—	—	6.2
4	6000	15	12	27	27
	0	3.6	0.17	0.17	—
	2	—	—	—	6.8
5	6000	15	13	27	27
	0	3.8	0.08	0.17	—
	2	—	—	—	7.1
6	6000	13	12	27	27
	0	4.7	0.08	0.17	—
	2	—	—	—	8.7
7	6000	14	10	25	26
	0	3.8	0.08	0.17	—
	2	—	—	—	8.3
8	6000	14	12	25	25
	0	4.2	0.08	0.17	—
	2	—	—	—	8.8
9	6000	14.2	12	25	26
	0	4.2	0.08	0.17	—
	2	—	—	—	8.8
10	6000	14	12	25	26
	0	4.2	0.08	0.17	—
	2	—	—	—	8.8



Note: All lines 1/4 inch.
Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic

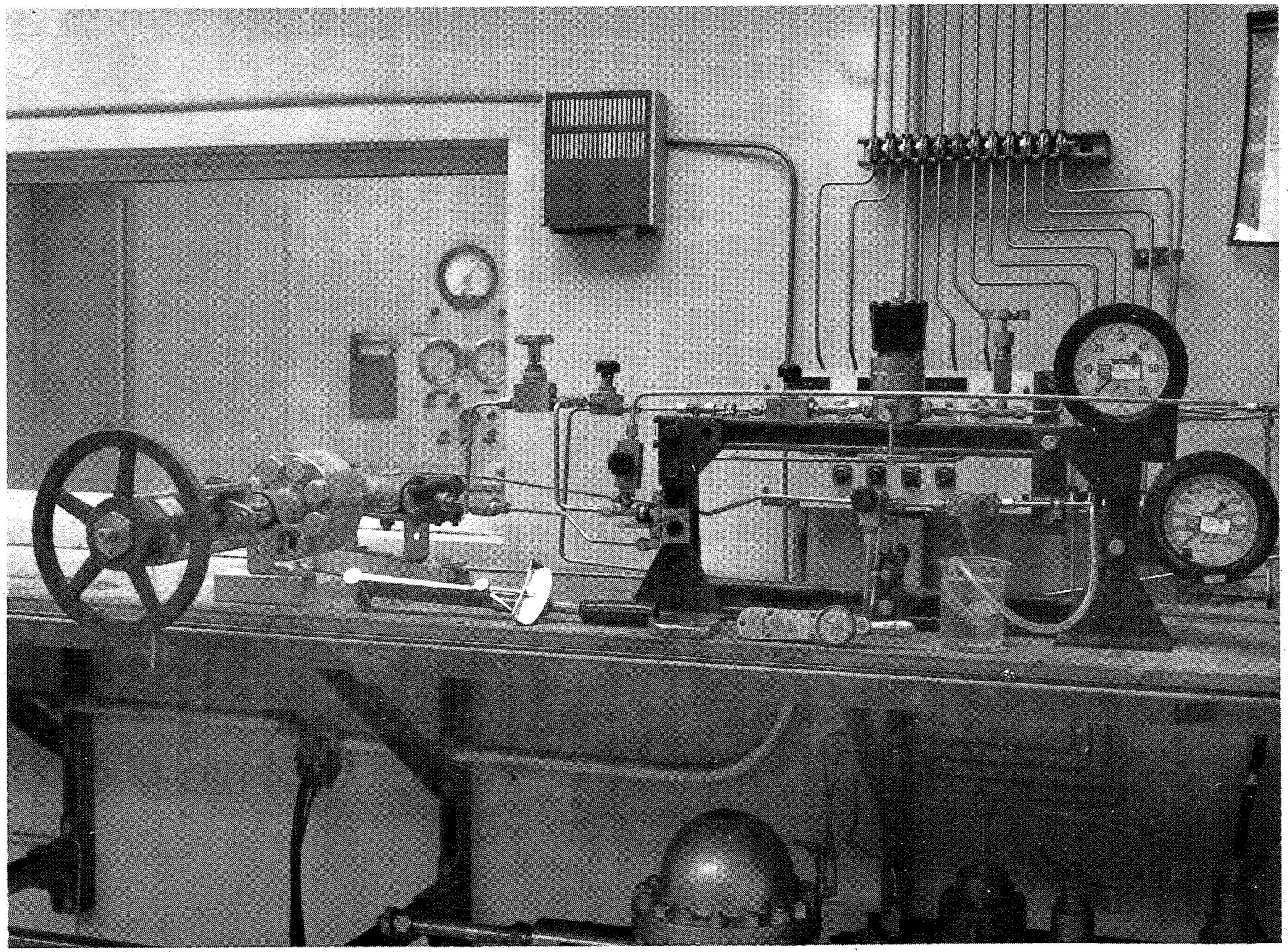


Figure 4-2. Functional Test Setup

SECTION V

FLOW TEST

5.1 TEST REQUIREMENTS

5.1.1 The valve capacity (C_v) of the specimen shall be determined.

5.1.2 A flow rate versus pressure drop curve shall be developed.

5.2 TEST PROCEDURE

5.2.1 The test specimen was installed in the test setup as shown in figures 5-2 and 5-3 using the equipment listed in table 5-1. Each hand valve and regulator 5 was closed.

5.2.2 The test specimen was opened.

5.2.3 Hand valve 3 was opened and gage 4 was monitored for 100 psig.

5.2.4 Regulator 5 was used to vary the flow through the system to obtain temperature and pressure data.

5.2.5 Eight readings of inlet pressure, pressure drop and water temperature were recorded from flowmeter 8, gages 9, 10 and 11, and thermocouple 7.

5.3 TEST RESULTS

5.3.1 The flow coefficient (C_v) of the 3/4-inch globe valve was an average of 8.9 when calculated over a flow range between 8 and 25 gallons per minute.

5.4 TEST DATA

5.4.1 The test data recorded during the test and during a functional test following the flow test are presented in tables 5-2 and 5-3. Flow rate versus pressure drop is presented in figure 5-1.

5.4.2 The flow coefficient (C_v) was computed using the following formula:

$$C_v = Q\sqrt{\frac{\rho_T}{\rho_{60°F}\ \Delta P}}$$

Where:

Q = Measured flow rate (gpm)
ΔP = Pressure drop across the specimen (psid)
ρ_T = Density of the water at the temperature indicated by the temperature probe
$\rho_{60°F}$ = Density of the water at 60°F

Table 5-1. Flow Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Pacific Valve Co.	3/4-S-172 50Y-12K-G L(XXS)	NASA 75M09618 PGLV-3	3/4-in. globe valve
2	Water Supply	NA	NA	NA	NA
3	Hand Valve	Williams Co.	200SP	NA	2-in.
4	Pressure Gage	Heise	NA	NASA 08-113-93-1092-C	0-to 1000-psig ±0.2% FS Cal date 12-30-66
5	Pressure Regulator	Denison Division, American Brake Shoe Company	FCC122 3106	NA	1-in.
6	Pressure Gage	Ashcroft	NA	NASA 08-113-95-1209-B	0-to 1000-psig ±1.0% FS Cal date 1-30-67
7	Thermocouple	West Instrument Corp.	30112	NA	-50 to +200 (±2.5)°F Cal date 2-31-67
8	Turbine Flowmeter	Cox Instrument Division	16-SCRX	3498	0-to 50-gpm Cal date 12-16-66
9	Pressure Gage	Heise		NASA 08-113-95-1637-B	0-to 100-psig ±0.2% FS Cal date 12-30-66
10	Pressure Gage	Heise		NASA 08-113-95-1083-C	0-to 100-psig ±0.2% FS Cal date 12-30-66
11	Pressure Gage	Heise		NASA 08-113-93-1064-C	0-to 100-psig ±0.2% FS Cal date 12-30-66
12	Hand Valve	Williams Co.	200 SP	NA	2-in.

Table 5-2. Flow Test Data

Flow (gpm)	Specimen Pressure		Tare (psig)	(psig)	Media Temperature (F)	Flow Coefficient (C_v)
	Upstream (psig)	Downstream (psig)				
8.0	6.3	5.4	0.0	0.9	50	8.4
10.0	10.4	9.0	0.0	1.4	50	8.5
12.0	15.1	13.2	0.0	1.9	50	8.7
14.0	20.7	18.1	0.1	2.5	50	8.8
16.0	27.1	23.7	0.2	3.2	50	8.9
18.0	34.1	30.1	0.4	3.6	50	9.5
20.0	42.4	37.3	0.4	4.7	50	9.2
25.0	65.4	57.8	0.5	7.1	50	9.4

Table 5-3. Data on Functional Test Following the Flow Test

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10
	0	6000	None	10

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	8.0	10.0	23.0	23.0
	0	6.0	3.0	1.0	—
	2	—	—	—	5.0
2	6000	8.0	11.0	23.0	20.0
	0	4.0	3.0	1.0	—
	2	—	—	—	5.0
3	6000	8.0	12.0	22.0	21.0
	0	4.0	2.0	1.0	—
	2	—	—	—	5.0

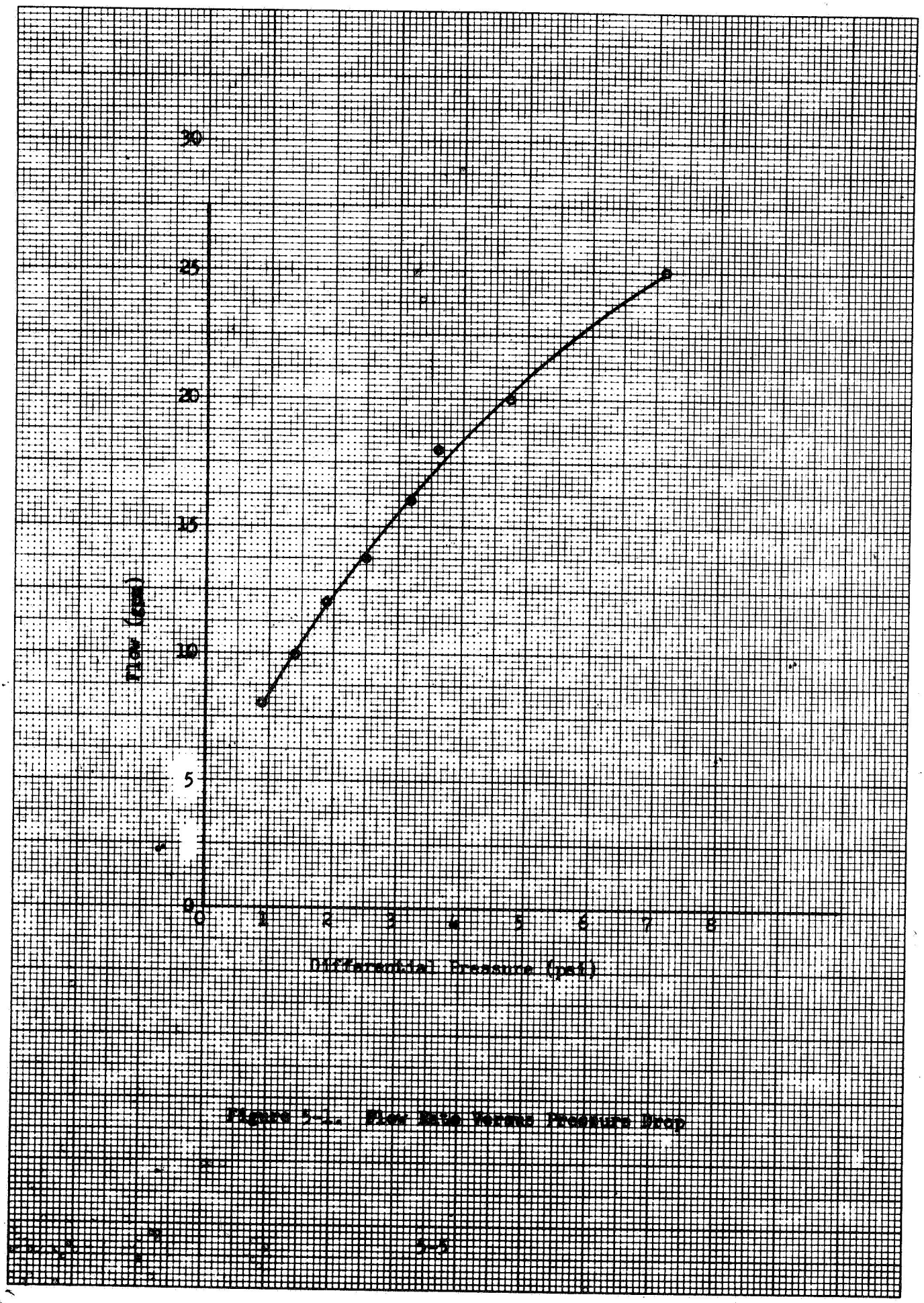
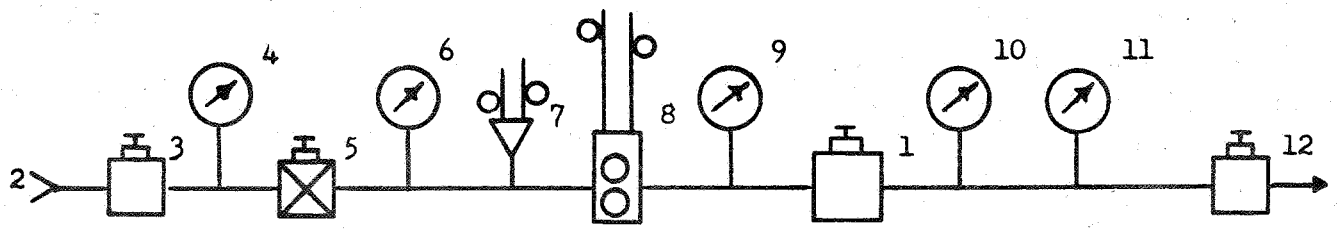


Figure 5-4. Flow Rate Versus Pressure Drop



Note: All lines 3/4-inch except for one-inch water source lines and 1/4-inch gage lines.
Refer to table 5-1 for item identification

Figure 5-2. Flow Test Schematic

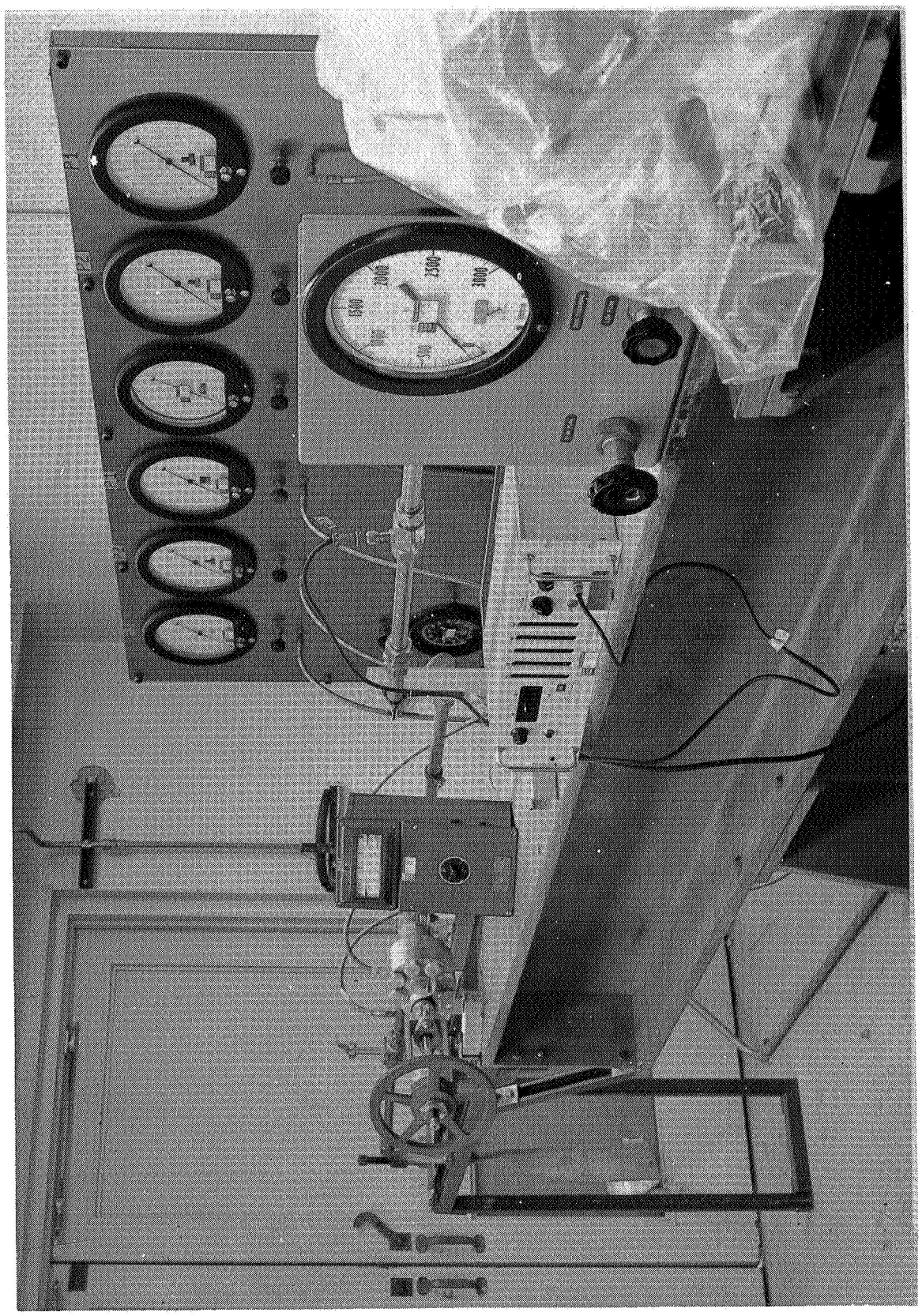


Figure 5-3. Flow Test Setup

SECTION VI

SEAT EROSION TEST

6.1 TEST REQUIREMENTS

6.1.1 A seat erosion test will be performed on the test specimen to determine whether the environment causes degradation or deformation.

6.1.2 The specimen shall be set to flow approximately 2 SCFM of GH_2 with an inlet pressure of 6000 psig and an outlet pressure below 3100 psig. The flow-rate shall be maintained for 120 hours.

6.1.3 The seat of the specimen shall be inspected for deterioration.

6.1.4 All test data shall be recorded.

6.2 TEST PROCEDURE

6.2.1 The seat erosion test was subcontracted by the Martin Marietta Corporation, Denver Division. The test procedure is described in Appendix A.

6.2 TEST RESULTS

The specimen was found to have no internal leakage at a closing torque of 40-ft-lbs. No performance degradation from seat erosion was observed after 120 hours of GN_2 at 2 SCFM.

6.3 TEST DATA

6.3.1 Seat erosion test data are presented in Appendix A.

6.3.2 The functional test following the seat erosion test is shown in table 6-1.

Table 6-1. Data on Functional Test Following The Seat Erosion Test

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10
	0	6000	None	10

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	8.0	10.0	23.0	23.0
	0	6.0	3.0	1.0	—
	2	—	—	—	
2	6000	8.0	11.0	23.0	20.0
	0	4.0	3.0	1.5	—
	2	—	—	—	
3	6000	8.0	10.0	23.0	21.0
	0	4.0	2.0	1.0	—
	2	—	—	—	5.0

7.3 TEST RESULTS (Continued)

The second ten cycles were performed with the specimen partially opened with a pressure of 0 to 6000 psig within 65 milliseconds. Functional test results following the surge test were satisfactory.

7.4 TEST DATA

7.4.1 A typical surge wave form as recorded during the test is presented in figure 7-1.

7.4.2 Functional test data following the surge test are presented in table 7-2.

Table 7-1. Surge Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Pacific Valve Co.	3/4-S-17250Y-12K-GL(XXS)	NASA 75M09618-PGLV-3	3/4-in. globe valve
2	Hand Valve	Combination Pump and Valve Co.	380-3	NA	1½-in. supply
3	Filter	Microporous	4813F-2M	NA	2-micron
4	Pressure Gage	Ashcroft	NA	NASA 08-113-200 594-P	0-to 10,000-psig ±0.2% FS Cal date 3-7-67
5	Pressure Regulator	Tescom Corp.	26-1002	1004	7000 psig inlet 0-to 7000-psig outlet
6	Pressure Gage	Ashcroft	NA	NASA 08-113-200 594-Q	0-to 10,000 psig ±0.2% FS Cal date 3-7-67
7	Hand Valve	Robbins Aviation	SSKG-250	NA	1/4-in.
8	Solenoid Valve	Marotta Valve Co.	MV-583	3696	3-way, ½-in.
9	Switch	Cutler & Hammer	NA	NA	28 VDC
10	Pressure Transducer	C.E.C.	416	NASA 95-1650	0-10,000 psig ±2% accuracy Cal date 6-10-67
11	Oscillograph	C.E.C.	5-124	012588	Recorder Cal date 1-3-67
12	Helium and Nitrogen Source	C.C.S.D.	NA	NA	7000 psig
13	Hand Valve	Robbins Aviation	SSKG 250-4T	NA	1/4-in.

Table 7-2. Data on Functional Test Following Surge Test

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10
	0	6000	None	10

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	6	7	22	22
	0	6	3	1	—
	2	—	—	—	5.0
2	6000	7	7	23	23
	0	4	3	1	—
	2	—	—	—	5.0
3	6000	5	7	22	22
	0	5	3	1	—
	2	—	—	—	5.0

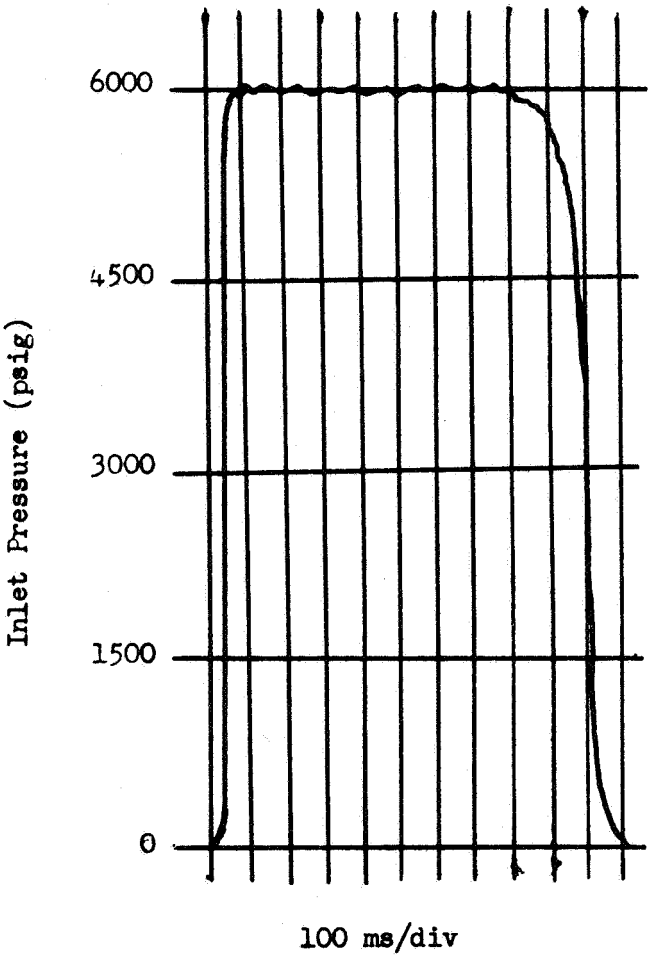
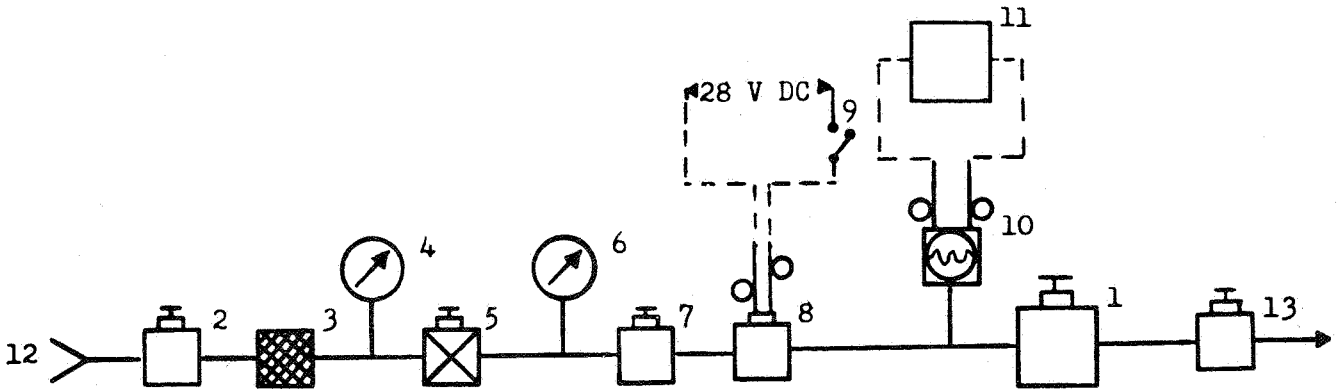


Figure 7-1. Typical Surge Waveform



Note: All lines 1/2-inch except for gage lines which are 1/4-inch.
Refer to table 7-1 for item identification.

Figure 7-2. Surge Test Schematic

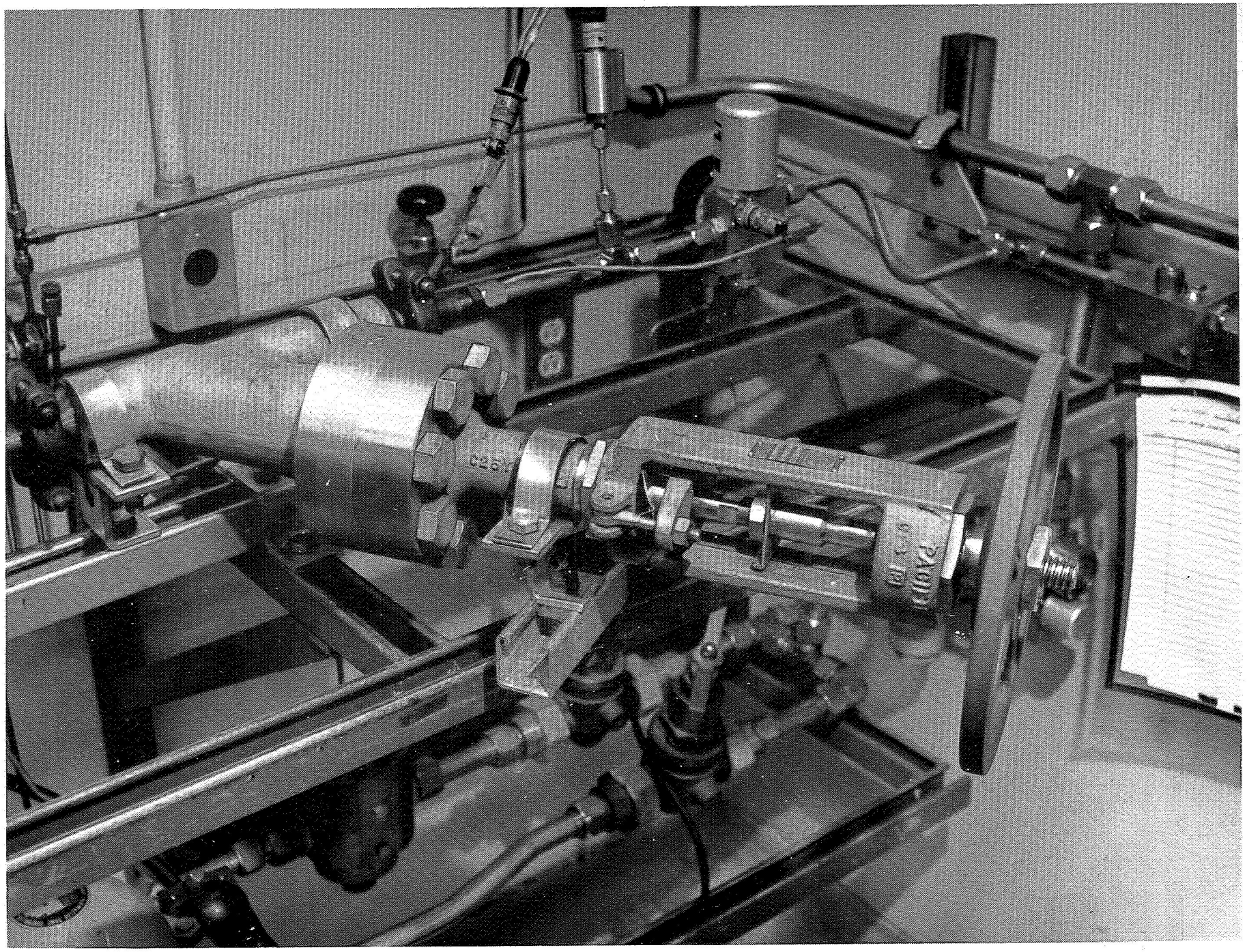


Figure 7-3. Surge Test Setup

SECTION VIII

LOW TEMPERATURE TEST

8.1 TEST REQUIREMENTS

8.1.1 The test specimen shall be subjected to a low temperature test at -20 (+0, -4)°F to determine whether the environment causes degradation or deformation.

8.1.2 The test specimen shall be subjected to a functional test in accordance with section IV during the low temperature test using helium as the test medium.

8.2 TEST PROCEDURE

8.2.1 The test specimen was installed in the test setup as shown in figures 4-1 and 8-1 using the test equipment listed in table 4-1.

8.2.2 With thermocouple 19 affixed to the specimen, thermal chamber 18 was cooled to -20°F and the relative humidity was maintained at the prescribed 60 to 90 percent.

8.2.3 Temperature stabilization was achieved and a functional test was performed.

8.2.4 The chamber was returned to ambient temperature and a second functional test was performed.

8.2.5 The specimen was visually inspected within one hour of its return to ambient temperature.

8.2.6 All test data were recorded.

8.3 TEST RESULTS

The test specimen was stabilized at -20°F and a functional test was performed. No leakage existed with the inlet port pressurized at 6000 psig and an applied torque of 15 ft-lb. No leakage existed when the specimen was functionally tested at ambient conditions.

8.4 TEST DATA

The test data recorded during the test are presented in tables 8-1 and 8-2.

Table 8-1. Data on Functional Test Performed at -20°F

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	15 ft-lb
	0	6000	None	15 ft-lb

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	8.0	7.0	22.0	22.0
	0	7.0	1.0	1.0	—
	2	—	—	—	7.0
2	6000	8.0	7.0	25.0	23.0
	0	4.0	1.0	1.0	—
	2	—	—	—	6.0
3	6000	7.0	8.0	26.0	26.0
	0	4.0	1.0	1.0	—
	2	—	—	—	6.0

Table 8-2. Data On Functional Test At Ambient Conditions

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10 ft-lb
	0	6000	None	10 ft-lb

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	6.0	8.0	24.0	24.0
	0	5.0	3.0	1.0	—
	2	—	—	—	6.0
2	6000	7.0	7.0	23.0	24.0
	0	7.0	8.0	23.0	—
	2	—	—	—	6.0
3	6000	7.0	8.0	23.0	23.0
	0	5.0	3.0	1.0	—
	2	—	—	—	6.0

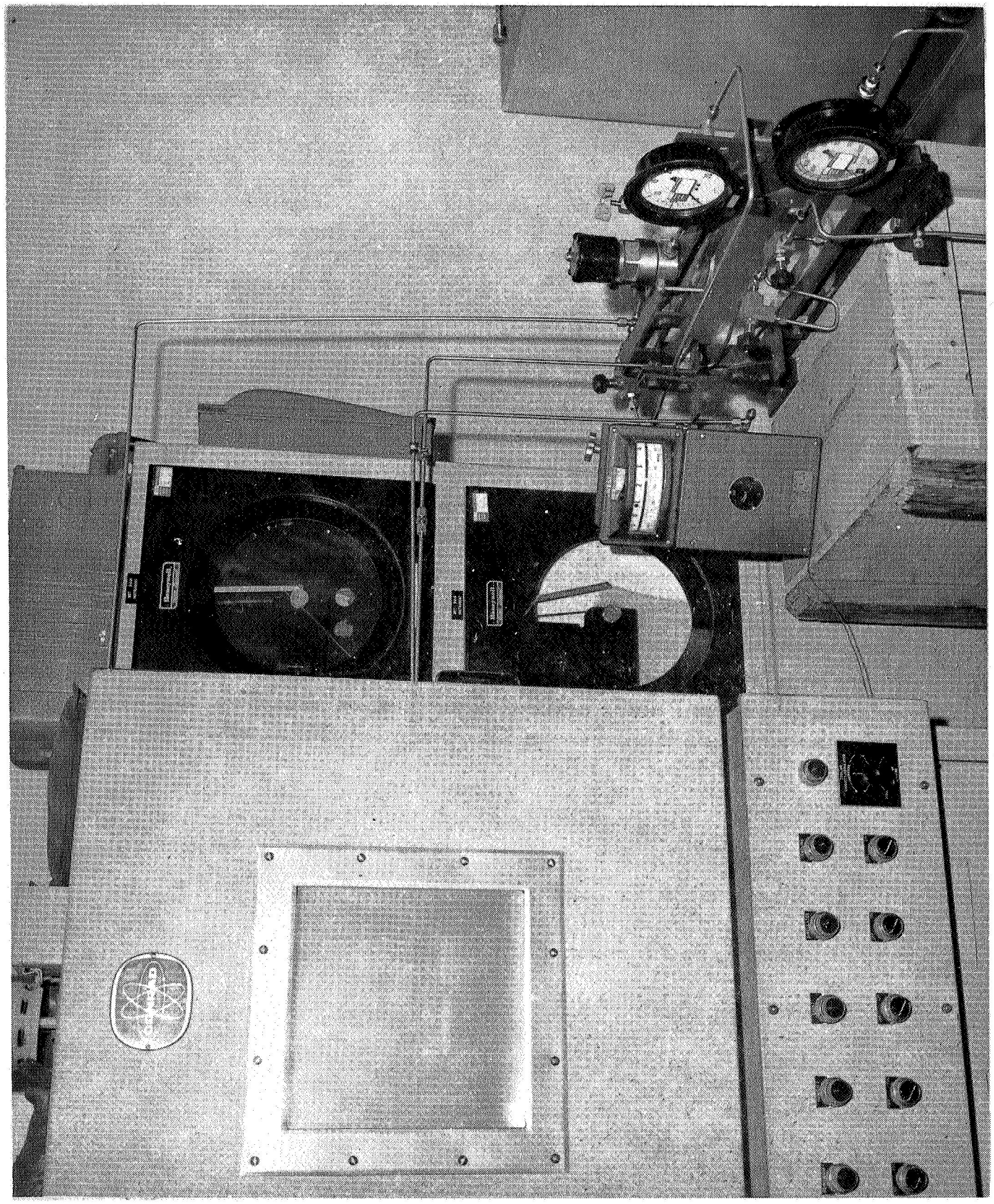


Figure 8-1. Low and High Temperature Test Setup

SECTION IX

HIGH TEMPERATURE TEST

9.1 TEST REQUIREMENTS

9.1.1 The test specimen shall be subjected to a high temperature test at 160 (+4, -0)°F for a period of 72 (+2, -0) hours to determine if the environment causes degradation of performance.

9.1.2 The test specimen shall be subjected to a functional test in accordance with section IV during and after the high temperature test using helium as the test medium.

9.2 TEST PROCEDURES

9.2.1 The test specimen was installed in the test setup as shown in figures 4-1 and 8-1 using the equipment listed in table 4-1.

9.2.2 With thermocouple 19 affixed to the specimen, the temperature of thermal chamber 18 was increased to 160°F at a rise rate of approximately 1° per minute. The humidity was maintained at 20 percent.

9.2.3 The temperature was maintained for 72 hours after temperature stabilization.

9.2.4 A functional test was performed while the sample and chamber were maintained at 160°F.

9.2.5 The chamber temperature was returned to ambient conditions upon completion of the functional test.

9.2.6 Within one hour following the establishment of ambient conditions, a visual inspection and a functional test were performed on the specimen.

9.3 TEST RESULTS

After 72 hours at 160°F the test specimen was functionally tested. No leakage existed. No leakage existed when the test specimen was functional tested when allowed to return to ambient conditions.

9.4 TEST DATA

The data recorded during the test are presented in tables 9-1 and 9-2.

Table 9-1. Data On Functional Test at +160°F

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	7 ft-lb
	0	6000	None	7 ft-lb

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	7.0	6.0	22.0	22.0
	0	3.0	1.0	1.0	—
	2	—	—	—	5.0
2	6000	7.0	7.0	22.0	22.0
	0	2.0	1.0	1.0	—
	2	—	—	—	5.0
3	6000	7.0	7.0	25.0	24.0
	0	3.0	1.0	1.0	—
	2	—	—	—	5.0

Table 9-2. Data On Functional Test At Ambient Conditions

Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10 ft-lb
	0	6000	None	10 ft-lb

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	6.0	8.0	25.0	27.0
	0	4.0	1.0	1.0	—
	2	—	—	—	5.0
2	6000	7.0	7.0	20.0	21.0
	0	4.0	1.0	1.0	—
	2	—	—	—	5.0
3	6000	7.0	7.0	22.0	22.0
	0	4.0	1.0	1.0	—
	2	—	—	—	6.0

SECTION X

SAND AND DUST TEST

10.1 TEST REQUIREMENTS

10.1.1 A sand and dust test shall be performed to determine the resistance of the valve specimen to the abrasive and corrosive characteristics of blown fine sand and dust.

10.1.2 The test specimen shall be subjected to 2 hours of exposure to fine sand and dust with a velocity of 100 to 500 feet per minute and a temperature of 77°F.

10.1.3 At the end of this 2-hour period the temperature shall be increased to 160°F. This temperature shall be maintained for an additional 2 hours.

10.1.4 Following the preceding exposure time, the specimen shall be allowed to cool to room temperature and shall be functionally tested and inspected.

10.2 TEST PROCEDURE

10.2.1 The inlet and outlet ports were capped and the test specimen was placed in a sand and dust chamber as specified in KSC-STD-164(D). The chamber contained sand and dust with the characteristics prescribed in KSC-STD-164(D).

10.2.2 The density of the sand and dust was maintained at 0.1 to 0.25 gram per cubic foot. The air velocity through the chamber was 100 to 500 feet per minute.

10.2.3 The internal temperature of the test chamber was set at 77°F and the system was started. These conditions were maintained for a period of 2 hours.

10.2.4 At the end of this period, the temperature was raised to 160°F. The specimen was subjected to a 2-hour test under these conditions.

10.2.5 The test specimen was removed from the chamber and allowed to cool to room temperature.

10.2.6 The accumulated dust was removed from the test specimen by brushing, wiping, and shaking. Care was taken so that additional dust was not introduced into the specimen.

10.2.7 The test specimen was subjected to a functional test as specified in section IV. The specimen was inspected for sand and dust deposits.

10.3 TEST RESULTS

The test specimen showed no deterioration or deformation after the sand and dust test.

10.4 TEST DATA

Functional test data recorded following the sand and dust test are presented in table 10-1.

Table 10-1. Data On Functional Test Following Sand and Dust Test

Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10 ft-lb
	0	6000	None	10 ft-lb

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	8.0	8.0	22.0	23.0
	0	5.0	1.0	1.0	—
	2	—	—	—	5.0
2	6000	7.0	8.0	22.0	23.0
	0	3.0	1.0	1.0	—
	2	—	—	—	5.0
3	6000	7.0	7.0	22.0	23.0
	0	3.0	1.0	1.0	—
	2	—	—	—	5.0

SECTION XI

SALT FOG TEST

11.1 TEST REQUIREMENTS

11.1.1 The test specimen shall be subjected to a salt fog test. The test specimen shall be placed in a test chamber with all the equipment described in KSC-STD-164(D). The specimen shall be subjected to an atomized salt solution for a period of 240 ($\pm$2) hours.

11.1.2 The solution shall contain 5 parts by weight of salt in 95 parts by weight of water with no more than 200 parts per million of total solids. The specific gravity of the salt solution shall be from 1.023 to 1.037 with a reference temperature of 95 (+2, -4)°F. The salt solution shall also have a pH value of 6.5 to 7.2. Diluted, chemically pure (CP) hydrochloric acid or CP sodium hydrozide may be used to adjust the pH value.

11.1.3 Measurements of the characteristics of the salt solution shall be made according to KSC-STD-164(D).

11.1.4 Following the exposure of 240 hours, the test specimen shall be subjected to a functional test within 1 hour after returning to room ambient conditions.

11.2 TEST PROCEDURE

11.2.1 The test specimen was visually inspected for corrosion, dirt, and oily films. All unnecessary oily film and dirt particles were removed. No corrosion spots were observed.

11.2.2 The test specimen was placed in a salt spray chamber with its ports capped.

11.2.3 The chamber temperature was adjusted to 95 (+2,-4)°F and the salt solution density was adjusted so that the clean fog-collecting receptacle in the exposure zone would collect from 0.5 to 3 milliliters of solution per hour for each 80 cm^2 of horizontal collecting area.

11.2.4 These conditions were maintained for 240 hours.

11.2.5 At the end of the 240-hour period, the test specimen was removed from the chamber and allowed to return to room ambient conditions.

11.2.6 The salt deposits were removed from all threaded areas to provide adequate mechanical connections.

11.2.7 After returning the specimen to room ambient conditions, a functional test was performed, as specified in section IV.

11.2.8 The test specimen was inspected and all salt deposits were removed.

11.3 TEST RESULTS

The test specimen showed no deterioration or deformation after the salt fog test.

11.4 TEST DATA

Functional test data recorded following the salt fog test are presented in table 11-1.

Table 11-1. Data On Functional Test Following Salt Fog Test

Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	None	10 ft-lb
	0	6000	None	10 ft-lb

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	7.0	6.0	18.0	12.0
	0	7.0	1.0	1.0	—
	2	—	—	—	5.0
2	6000	7.0	6.0	18.0	10.0
	0	3.0	1.0	1.0	—
	2	—	—	—	4.0
3	6000	7.0	5.0	19.0	10.0
	0	3.0	1.0	1.0	—
	2	—	—	—	5.0

SECTION XII

SEAT EROSION TEST

12.1 TEST REQUIREMENTS

12.1.1 An additional seat erosion test shall be performed on the test specimen to determine whether high velocity flow causes degradation or deformation.

12.1.2 The specimen shall be set to flow approximately 100 SCFM of GN_2 with an inlet pressure of 6000 psig and an outlet pressure below 50 psig. The flow rate shall be maintained for four hours.

12.1.3 A functional test shall be performed if 72 hours had elapsed since the last functional test and shall also be performed within one hour following the seat erosion test.

12.2 TEST PROCEDURE

12.2.1 A functional test was performed according to section IV due to 72 hours lapse time since the last functional test.

12.2.2 The test setup was then assembled as shown in figure 12-1 and 12-2 using the equipment listed in table 12-1.

12.2.3 Hand valve 3 was closed and pressure regulator 5 was adjusted for zero outlet pressure.

12.2.4 Hand valve 3 was opened.

12.2.5 Pressure gage 8 read 6500 psig.

12.2.6 Pressure regulator 5 was adjusted to establish 6000 psig on pressure gage 6.

12.2.7 The test specimen was slowly opened until 21.7 psig $\pm 5\%$ accuracy was monitored on pressure gage 7, and a temperature reading of 0°R ± 5°F was read on temperature recorder 11. This established a flow rate of approximately 100 SCFM through calibrated flow nozzle 9.

12.2.8 The flow was continued for four hours. Pressure gauge 7 was monitored for an increase in flow rate which could indicate erosion of the valve seat.

12.2.9 Hand valve 3 was closed and the test specimen was removed from the system.

12.2.10 A functional test was performed within one hour following the seat erosion test.

12.2.11 All test data were recorded.

12.3 TEST RESULTS

The test specimen successfully withstood the high velocity flow of 100 SCFM for a total of four hours. The results during and following the seat erosion test were satisfactory.

12.4 TEST DATA

Information monitored during the seat erosion test are shown in table 12-2. Functional test data before and after the seat erosion test are shown in tables 12-3 and 12-4.

Table 12-1. Seat Erosion Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Pacific Valve Co.	3/4-S-17 250Y-12K-GL(XXL)	15551	3/4-inch globe valve
2	GN_2 Source	CCSD	NA	NA	7000-psig
3	Hand Valve	Cardair Co.	35100077	NA	1-$\frac{1}{2}$-inch
4	Filter	Permanent Filter Division	9377-3154	CPB-010	2-micron
5	Pressure Regulator	Tescom Corp.	26-1021-10	1529	7000-psig inlet 0-to 6000-psig outlet
6	Pressure Gauge	Heise	H-34955	014231	10,000-psig $\pm$2% FS accuracy Cal. date 7-17-67
7	Pressure Gauge	Heise	NA	95-1409-B	0-100 psig $\pm$ 1% FS accuracy Cal. date 8-1-67
8	Pressure Gauge	Heise	H-35980	015536	5000 psig $\pm$2% FS accuracy Cal. date 8-1-67
9	Nozzle	Flow-Dyne Engineering, Inc.	XN160 430-5A	2375	Throat diam. 0.4545 inch 6000 psi opr pressure
10	Thermocouple	Minneapolis-Honeywell	30112	NA	-50 to 200($\pm$2.5°F)
11	Temperature Readout	West Instrument	NA	019457	-100°F to 400°F Cal. date 10-16-67
12	Gauge Saver	Fisher Controls, Inc.	NA	NA	0-50 psig

Table 12-2. Four Hour Seat Erosion Test Data

Half Hour Readings	Specimen Inlet Pressure (psig)	Specimen Outlet Pressure (psig)	Temperature		Flow Rate (SCFM)
			°F	Rankine	
1	6000	22.0	-10	450	100 SCFM
2	6000	22.7	-5	455	(±5 SCFM)
3	6000	23.7	+2	462	Through a cali-
4	6000	21.0	+4	464	brated .4545
5	6000	23.0	+4	464	inch diameter
6	6000	22.8	+8	468	nozzle
7	6000	21.7	+9	469	
8	6000	22.6	+3	463	
9	6000	20.5	-10	450	

Table 12-3. Data On Functional Test After 72 Hours Delay

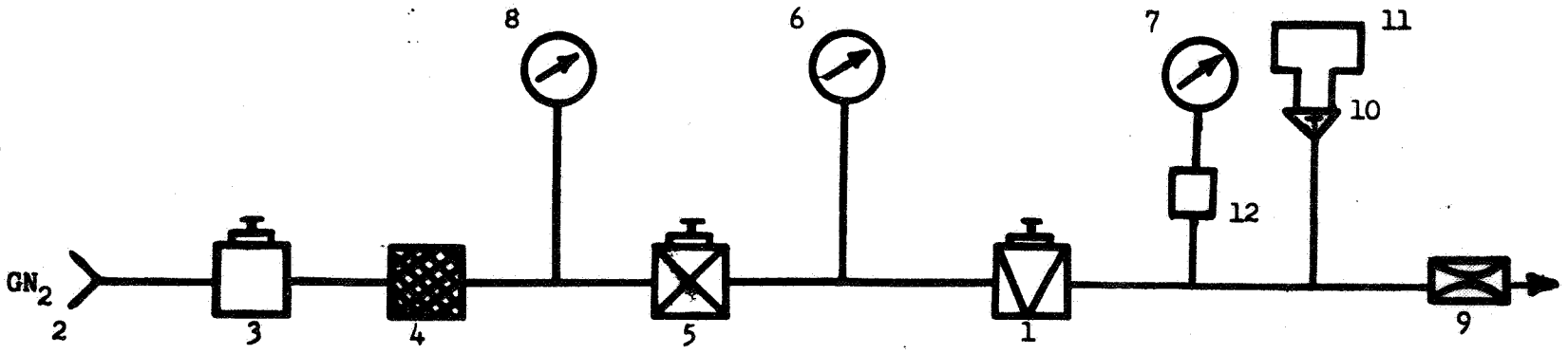
Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	0	8
	0	6000	0	8

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	8	8	20	8
	0	3	1	1	—
	2	—	—	—	4
2	6000	7	8	22	8
	0	3	1	1	—
	2	—	—	—	4
3	6000	9	10	22	8
	0	3	0.5	0.5	—
	2	—	—	—	4

Table 12-4. Data On Functional Test Following Seat Erosion Test

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	0	10
	0	6000	0	10

Run.	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	8	8	22	10
	0	6	0.5	0.5	—
	2	—	—	—	6
2	6000	9	8	23	10
	0	3	0.5	0.5	—
	2	—	—	—	5
3	6000	9	9	22	10
	0	3	0.5	0.5	—
	2	—	—	—	6



Note: Refer to table 12-1 for item identification.

Figure 12-1. Seat Erosion Test Schematic

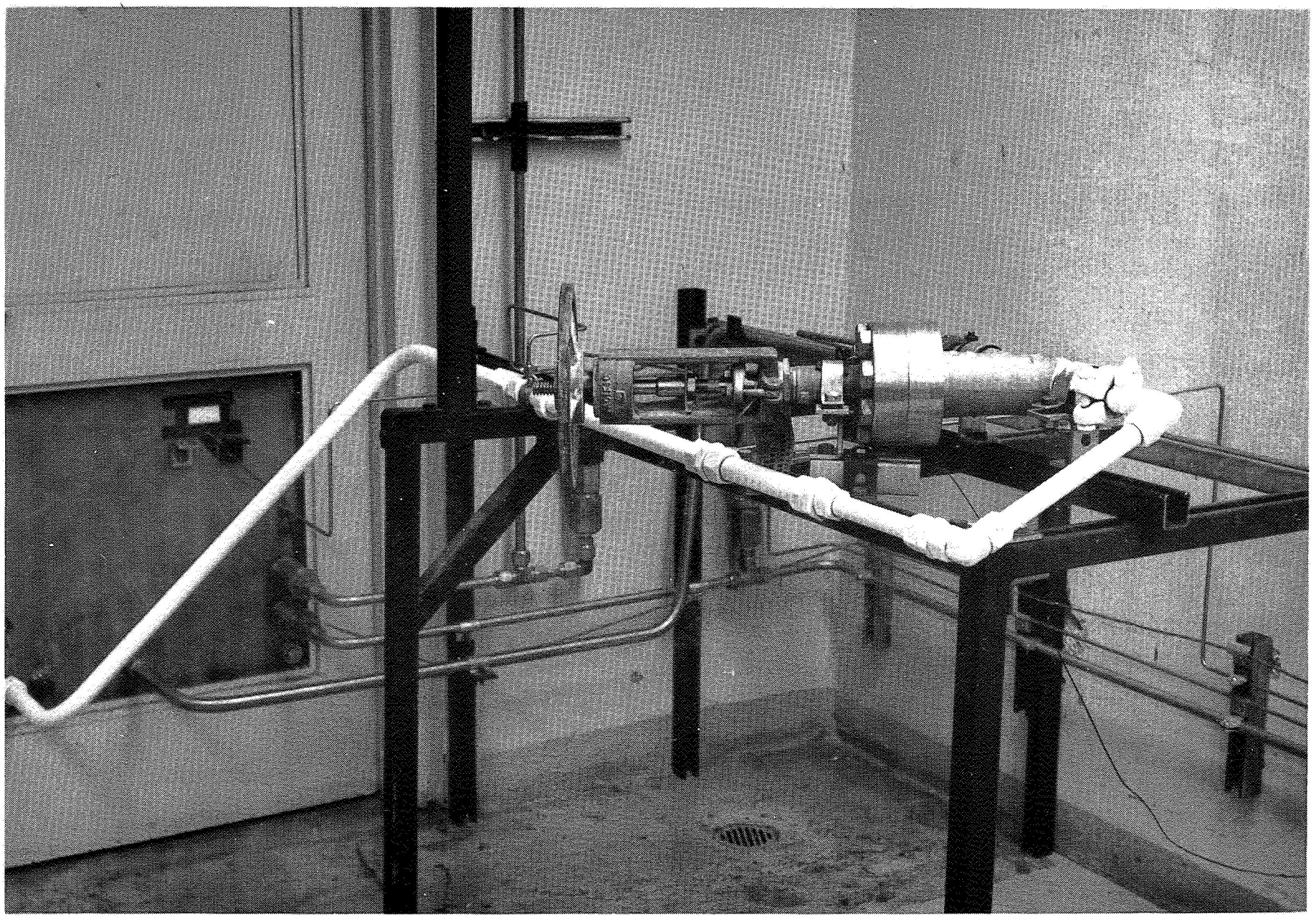


Figure 12-2. Seat Erosion Test Setup

SECTION XIII

CYCLE TEST

13.1 TEST REQUIREMENTS

13.1.1 A cycle test shall be performed on the test specimen to determine whether the environment causes degradation or deformation.

13.1.2 Each cycle shall consist of pressurizing the inlet port to 6000 psig and opening and closing the specimen.

13.1.3 Certain cycles (to be called type 1) shall be performed with the specimen vented to the atmosphere and with a minimum restriction upstream of the specimen. The other cycles (type 11) shall be performed with a downstream valve closed. However, this downstream valve will be opened between cycles to vent the specimen.

13.1.4 Cycles shall be performed in groups as specified in table 13-1. A functional test shall be performed following each group of cycles. A total of 1000 cycles shall be performed.

13.2 TEST PROCEDURE

13.2.1 The test setup was assembled as shown in figures 13-1 and 13-2 using the equipment listed in table 13-2.

13.2.2 All valves were closed and the pressure regulators were adjusted for zero outlet pressure.

13.2.3 Hand valve 10 was opened.

13.2.4 Hand valves 4 and 6 were opened.

13.2.5 Pressure regulator 5 was adjusted to establish 6000 psig on pressure gauge 8.

TYPE I CYCLES

13.2.6 Solenoid valves 16a, 16b, and 16c were energized to the open position.

13.2.7 Solenoid valve 9 was energized allowing dome pressure on regulator 11 which in turn established 6000 psig on pressure gauge 13.

13.2.8 The motor 15 was rotated counterclockwise by energizing cycle timer 17 causing the specimen to open.

13.2.9 The motor 15 was then reversed by changing polarity on cycle timer 17, whereby closing the specimen.

TYPE II CYCLES

13.2.13 Solenoid valve 9 was energized allowing dome pressure on regulator 11, which in turn established 6000 psig on pressure gauge 13.

13.2.14 The motor was rotated counterclockwise by energizing cycle timer 17, causing the specimen to open.

13.2.15 The motor 15 was then reversed by changing the polarity on cycle timer 17, whereby closing the specimen.

13.2.16 Solenoid 16c was energized to vent the downstream side of the specimen.

13.2.17 Solenoid valve 16c was then de-energized to the closed position.

13.3 TEST RESULTS

The specimen was successfully cycled until cycle 562, at which time excess leakage through the seat became apparent. The specimen was disassembled and it was noted that the seat was badly eroded. Cycle testing was discontinued at the request of CCSD-FO; however, the specimen was re-assembled in order to perform a burst test.

13.4 TEST DATA

13.4.1 Functional test data after 25, 50, 100 and 500 cycles are shown in tables 12-3 through 12-6.

13.4.2 Seat failure after 562 cycles is shown in figure 13-3.

Table 13-1. Cycle Sequence

Group	Cycles in Group	Cycle Type
1	1-25	I
2	26-50	II
3	51-100	I
4	101-500	II
5	501-975	II
6	976-1000	I

Table 13-2. Cycle Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Pacific Valve Co.	3/4-S-17 25 OY-12K -GL(XXS)	NASA 75M09618 PGLV-3	3/4-inch globe valve
2	GN_2 Source	Air Products			0-10,000 psig
3	Filter	Permanent	93773154	6PB-010	2-micron
4	Hand Valve	Aminco	44-13126	58965	0-30,000 psig
5	Pressure Regulator	Tescom Corp.	26-1021-20	3024	10,000 in - 10,000 out
6	Hand Valve	Aminco	44-13126	58965	0-30,000 psi
7	Vent Valve	Aminco	44-13106	50011A	0-30,000 psi
8	Pressure Gauge	Heise	014231	H34955	0-10,000 psig Cal. date 1-10-68
9	Solenoid Valve	Marotta	MB-510-H	190	0-6000
10	Control Valve	Fisher	470-D	3572094	0-10000 psi
11	Dome Regulator	Grove Valve	211-B	110751-1	0-10000 psig
12	Thermocouple	Minneapolis-Honeywell	NA	NA	-50 to 200 ($\pm$2.5)°F
13	Pressure Gauge	Heise	95-1653-B	H49480	0-10,000 psig Cal. date 1-10-68
14	Clutch	Boston	Type-U	R-025956	35 RPM
15	Motor	Westinghouse	Type-CSP	CNO-5943	3 HP
16	Solenoid Valve	Marotta	MB-583	2885	0-6000
	Solenoid Valve	Marotta	MB-583	2916	0-6000
	Solenoid Valve	Marotta	MB-583	372	0-6000
17	Cycle Timer	Cramer Controls	540	Y3336A	115 vdc

Table 13-3. Functional Data Test (After 25 Cycles)

Run	Inlet Press. (psig)	Outlet Press. (psig	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	0	21
	0	6000	0	21

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	7	8	20	21
	0	7	3	0.5	—
	2	—	—	—	6
2	6000	6	7	18	21
	0	7	3	0.5	—
	2	—	—	—	6
3	6000	7	8	19	23
	0	6	3	0.5	—
	2	—	—	—	6

Table 13-4. Functional Test Data (After 50 Cycles)

Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	0	23
	0	6000	0	23

Run.	Specimen Inlet Press. (psig)	Opening Torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	6	3.6	17	23
	0	5	3	0.5	—
	2	—	—	—	6
2	6000	6	3.6	17	23
	0	5	3	0.5	—
	2	—	—	—	6
3	6000	6	4	17	22
	0	6	3	0.5	—
	2	—	—	—	7

Table 13-5. Functional Test Data (After 100 Cycles)

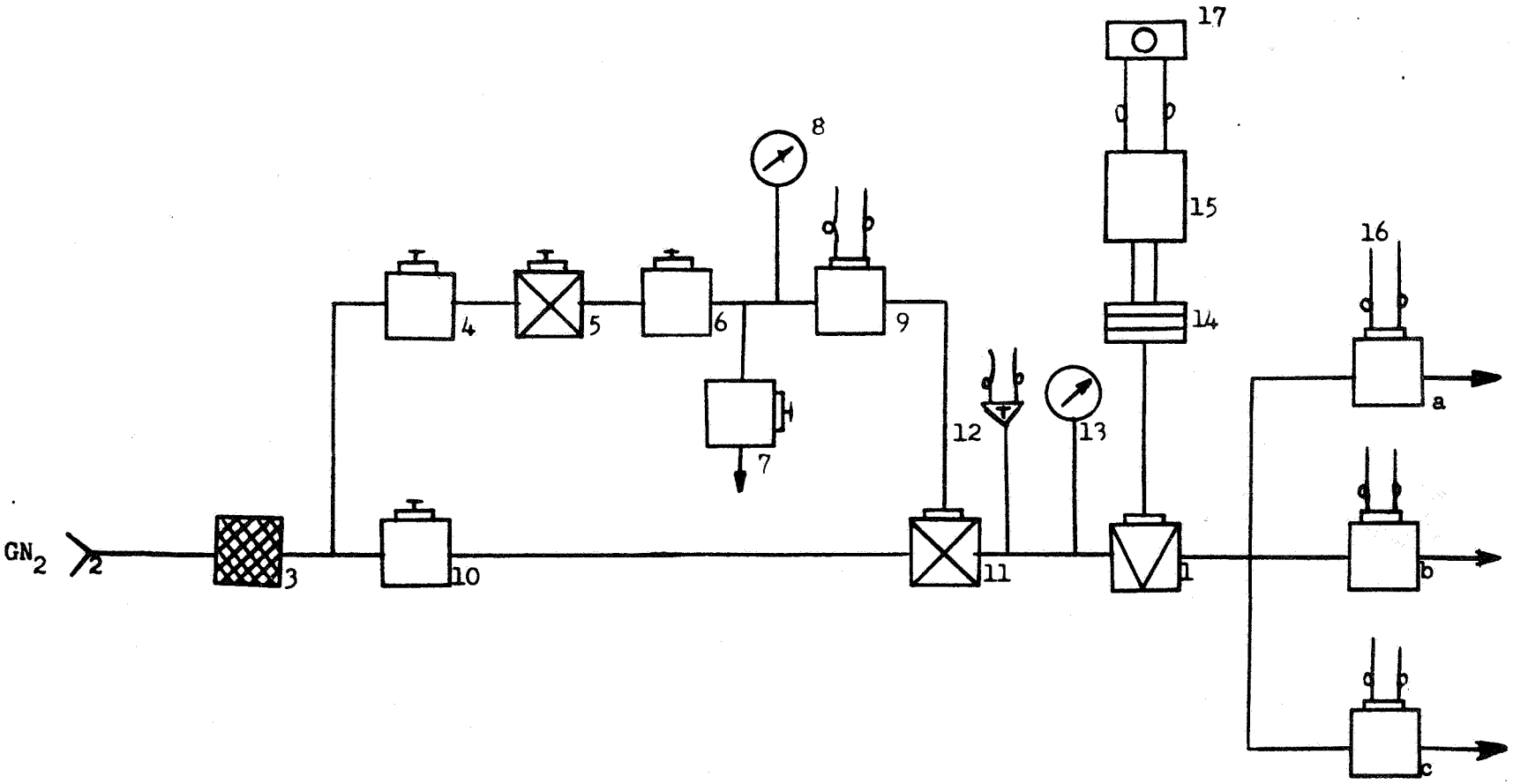
Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	0	25
	0	6000	0	25

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb) Opening	Running Torque (ft-lb) Closing	Closing Torque (ft-lb)
1	6000	6.2	3.5	15	23
	0	4	3	0.5	—
	2	—	—	—	5
2	6000	6	3.5	13.5	23
	0	3	3	0.5	—
	2	—	—	—	6
3	6000	6	3.5	13	23
	0	3	3.5	0.5	—
	2	—	—	—	6

Table 13-6. Functional Test Data (After 500 Cycles)

Run	Inlet Press. (psig)	Outlet Press. (psig)	Leakage (scim)	Seating Torque (ft-lb)
1	6000	0	0	23
	0	6000	0	23

Run	Specimen Inlet Press. (psig)	Opening torque (ft-lb)	Running Torque (ft-lb)		Closing Torque (ft-lb)
			Opening	Closing	
1	6000	8.0	10	22.5	22.5
	0	6	3	1	—
	2	—	—	—	6
2	6000	6.5	10	22	17
	0	5.5	2	1	—
	2	—	—	—	5
3	6000	6.5	10	23.5	22.5
	0	6	2	0.5	—
	2	—	—	—	6



Note: Main flow line 3/4-inch. All other lines 1/4-inch.
Refer to table 13-1 for item identification.

Figure 13-1. Cycle Test Schematic

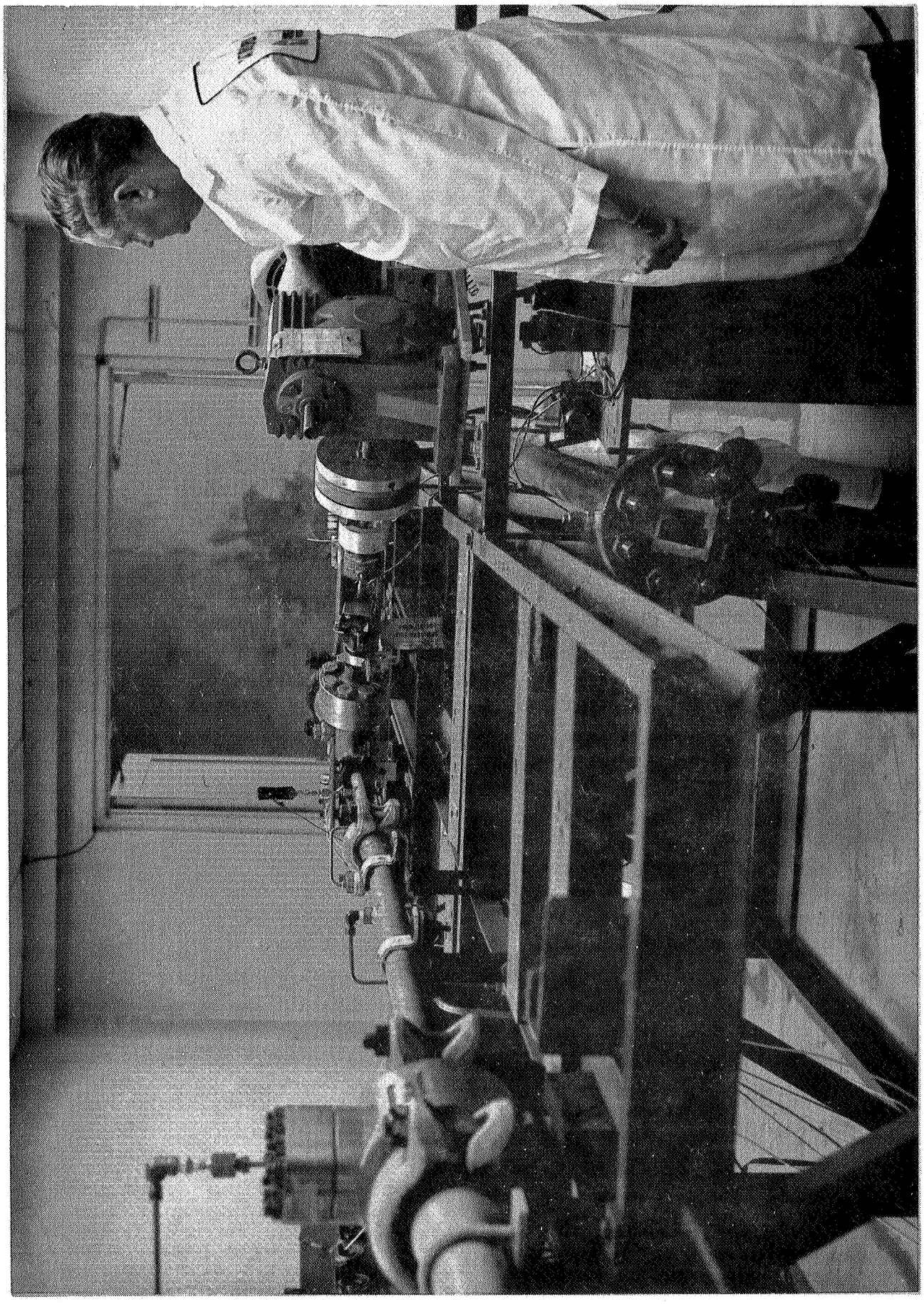


Figure 13-2. Cycle Test Setup

Figure 13-3. Seat Failure After 562 Cycles

SECTION XIV

BURST TEST

14.1 TEST REQUIREMENTS

14.1.1 The specimen shall be subjected to a hydrostatic pressure of 24,000 psig.

14.1.2 The hydrostatic pressure shall be applied to the specimen inlet port with the valve in the open position and the outlet port capped. The pressure shall be maintained for 5 minutes.

14.2 TEST PROCEDURE

14.2.1 The test specimen was installed in the test setup as shown in figures 3-1 and 14-1 utilizing the equipment listed in table 3-1.

14.2.2 Hand valve 7 and regulator 21 were closed.

14.2.3 The test specimen and hand valves 5, 6, 8, 9, 10, and 11 were opened and the system was filled with water. All air was bled from the system.

14.2.4 Hand valves 5, 8, 9, and 11 were closed.

14.2.5 Hand valve 7 was opened, and 3000 psig GN_2 was monitored on gage 14.

14.2.6 Regulator 21 was adjusted until a pressure of between 50 and 100 psig was indicated on gage 15.

14.2.7 Switch 17 was then closed. Solenoid valve 18 was opened and pump 19 started.

14.2.8 The pump continued to operate until a pressure of 22,000 psig was reached. At that level, a water leak was noticed under the door of the burst chamber. The pressure then decreased and all attempts to bring the pressure up failed.

14.2.9 Hand valves 9 and 11 were opened and the system was vented.

14.2.10 All data were recorded.

14.3 TEST RESULTS

The specimen did not reach 24,000 psig during the burst test. Water leakage occurred at 22,500 psig through the bonnet gasket and escaped through the gland flange.

14.4 TEST DATA

Test data are presented in table 14-1.

Table 14-1. Burst Test Data

Specimen	Ports Pressurized H_2O	Minimum Burst Pressure psig	Applied Pressure PSLG	Remarks
1	The inlet port was pressurized with the valve opened and the outlet port capped.	24,000	22,500	Leakage occurred through the bonnet gasket before the minimum burst pressure was reached.

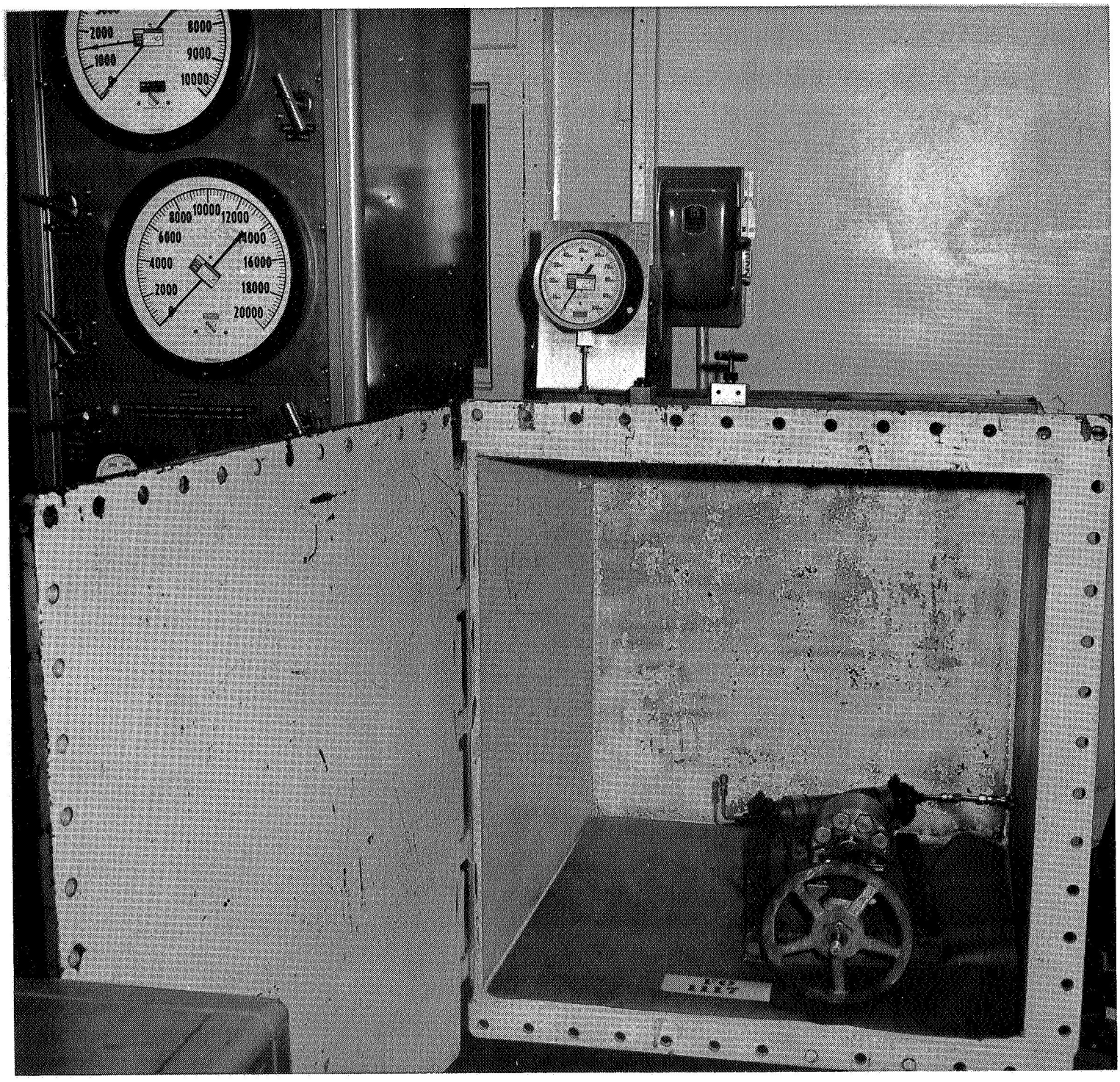


Figure 14-1. Burst Test Setup

Appendix A

MARTIN-MARIETTA CORPORATION

DENVER DIVISION

COLD FLOW LABORATORY

QUALIFICATION TESTING OF AGE COMPONENT GLOBE VALVE, ¾ INCH, 6000 psig P/N 3/4-S-17250Y-12K-GL(xxs) NASA P/N 75M09618 PGLV-3

for

CHRYSLER CORPORATION SPACE DIVISION

by

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C. A. HALL, Program Manager
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Denver Division

TEST REPORT

Test Number H40122

QUALIFICATION TEST OF 3/4 IN. PACIFIC GLOBE VALVE FOR CHRYSLER CORP.

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TEST REPORT

Test Number H40122

QUALIFICATION TESTING OF 3/4 INCH PACIFIC GLOBE VALVE

Introduction

This test was run by the Cold Flow Laboratory at the Denver Division of Martin-Marietta Corporation under a contract from the Space Division of Chrysler Corporation.

The purpose of the test was to perform functional and seat erosion phases of an AGE Component Qualification Test Program per Section VI of Chrysler Corporation Space Division Test Procedure TP-RE-CCSD-FO-1117-2F.

The test was conducted in Test Cell 3 and the Cell 1 catch basin area at the Cold Flow Laboratory between 28 April 1967 and 12 May 1967.

Summary

Functional tests were performed on the ¾ inch Pacific Globe valve using 6000 psig Helium gas. The valve was found to have no internal leakage at a closed torque of 40 ft-lbs. No performance degradation from seat erosion was observed after 120 hours of gaseous hydrogen flow at a flowrate of approximately 2 SCFM. Disassembly and visual inspection after the test verified that seat erosion was insignificant.

Test Objectives

The specific objective of this test was to determine the seat erosion caused by high pressure gaseous hydrogen flowing at very low flow rates for 120 hours.

Test item condition was to be evaluated before and after the seat erosion tests by means of functional tests for leakage and valve operating torque requirements.

Test Article

Valve, ¾ inch Globe, Pacific Valve Company

P/N 3/4-S-17250Y-12K-GL(xxs)
NASA P/N 75M09618 PGLV-3

References

1. P. O. NOB34998-C (7-W-06080)

2. Chrysler Corporation Change #1 to P. O. NOB34998-C(7-W-06080).

3. Test Plan H50579, Qualification Testing of AGE Components - Martin Marietta Corporation, Denver Division, 20 February 1967.

4. Chrysler Corporation Space Division Test Procedure TP-RE-CCSD-FO-1117-2F.

5. Martin-Marietta Corporation, Denver Division, Cold Flow Laboratory, Test Procedure H40122.

Test Fixture Description

The test fixture was built per Cold Flow Laboratory Drawing CFL 6300197C. Test fixture schematics are presented as Figures 1 and 2 of this report.

The functional test fixture (Figure 1) was built in Test Cell 3 and is shown in photograph DAO 41689.

The seat erosion test fixture (Figure 2) was built at the Cell 1 catch basin area and is shown in photograph DAO 41817.

The equipment used in the test fixture is itemized in Tables I and II for the functional and seat erosion fixtures respectively.

Test Method

The functional test was performed in Test Cell 3 in the following manner. Helium gas at 6000 psig pressure was applied to the test valve outlet with the valve closed and torqued to a maximum of 60 ft-lbs* and leakage, if any, through the valve was measured. The valve was then reversed and 6000 psig helium was applied to the inlet, and internal leakage was measured. The break-away torque, opening and closing running torques and the reclosing or seating torque was then measured with the valve unpressurized and also with 6000 psig helium applied to the valve inlet. The torque valves were measured using a torque wrench and a crowfoot adapter to fit the valve hand wheel retaining nut. Torque values were corrected to account for the adapter length by the following equation:

$$Ta = \frac{TW(L + A)}{L}$$

---

* The maximum closing torque per TP-RE-CCSD-FO-1117-2F was 10 ft-lbs. This value was changed by the Chrysler Corporation technical representative to 60 ft-lb maximum torque during a telephone conversation with the Martin Marietta Program Manager.

where:

Tw = torque wrench reading
Ta = actual torque applied
L = torque wrench length
A = adapter length

The reclosing torque was determined by cracking the valve until bubbles appeared in the water tank and then measuring the torque required to close the valve until the bubbles ceased. This was accomplished using 2 psig pressure at the valve inlet to get the unpressurized closing torque.

The seat erosion test was performed by adjusting the valve to flow gaseous hydrogen at a flowrate of 2 ± 0.5 SCFM with a valve inlet pressure of $6000 \begin{smallmatrix} +300 \\ -0 \end{smallmatrix}$ psig. The hydrogen gas inlet temperature was uncontrolled (ambient temperature). The flowrate was verified every two hours and readjusted to the required flowrate if required. The flow was continued for a total of 120 hours of flow time.

Test Data and Results

Inspection of the test item prior to start of the functional test revealed several dents in the lower valve body flange. The Grayloc fittings were removed for proof pressure testing and were found to be contaminated with a rusty deposit. One contaminated end fitting is shown in photograph DAO 41746. The rusty contamination was also visible in and around the valve seat area. The test item was disassembled, at Chrysler Corporation's direction, for inspection and cleaning. The Kel-F seat was found to have a shaved area, with the Kel-F shaving attached. A close up of the as received seat is shown in photograph DAO 41845. The seat also showed evidence of deformation due to closing torque load causing material cold flow. The valve was cleaned and reassembled using only the original valve parts.

Data obtained during the functional testing is presented in the enclosed test data sheet. During the torque determination phase of the test, it was found that the valve had about ½ turn slack in the operator threads. This caused the valve handwheel to move freely after break-away for ½ turn, and then torque built up to the running torque value. The valve would not open slowly, but would suddenly jump off the seat. After closing, with 6000 psig on the inlet, the valve could be opened until bubble leakage was observed and then reclosed with 20-25 inch-lbs torque. If the valve was opened until the poppet "jumped" off the seat, 30 to 40 ft-lbs of torque were required to reclose the valve. As indicated by the data sheet, the torque values required were less after the seat erosion test than before. This could be a result of relubrication of the shaft bearing and threads during the seat erosion testing.

The seat erosion test was performed between 1 May 1967 and 12 May 1967. The test item was subjected to 120 hours of hydrogen flow at an inlet pressure of 6000 psig and a flowrate of 2 ± 0.5 SCFM. It was found that the flowrate was very difficult to adjust with this valve due to the sudden opening characteristic and the tendency of the pressure (on top of poppet) to reclose the valve at settings that would flow the required amount. The flowrate was checked every two hours during the flow and readjusted as required. It was found that the ¼ inch valve required adjustment to increase the flow during each check period. There was never any indication of increase in flowrate between adjustments.

Following the seat erosion testing and the final functional test, the valve was disassembled for inspection. The Kel-F seat appeared to be deformed (due to closing torque) more than prior to testing. No evidence of seat erosion was seen on the Kel-F seat or the mating stainless steel seat in the valve body. Evidence of uneven seating can be seen approximately 270° around the Kel-F seat. Photographs of the seat and disassembled valve (DAO 41986 and DAO 41988) are included in this report. At Chrysler Corporation's direction, the valve will not be reassembled, but will be returned disassembled.

Conclusions

Gaseous hydrogen flowing for 120 hours at 2 ± 0.5 SCFM and 6000 psig valve inlet pressure through the test item appeared to have no serious degrading effect on the test item seat. Internal and external leakage was zero before and after the flow test at 6000 psig helium pressure.

Test No. H40122

TEST DATA SHEET

NAME: Pacific Valve Company

P/N: 3/4-S-17250Y-12K-GL(xxs)

MEDIUM: Helium

Cycle No.	Applied Seating Torque Ft-lbs.	Inlet Port Pressurized		Outlet Port Pressurized		Torque Breakaway Ft-lb.		Torque Reseating Ft-lb.		Running Torque Ft-lb.			
		Internal Leakage SCIM	External Leakage SCIM	Internal Leakage SCIM	External Leakage SCIM					To Open		To Close	
						6000 psig	0 psig	6000 psig	2 psig	6000 psig	0 psig	6000 psig	0 psig
1	40	--		0	0								
2	40	0	0			9	2.2	38.	11.7	15	2	33	2
3	40	0	0	0	0	11	2.2	24	2.5	1.1	1.1	22	2.2
4	40					11	2.2	13	2.5	5.6	2.5	11	2.2
5	20					2.2	1.1	13	2.5	5.6	1.1	11	1.1
6	20					2.2	1.1	13	2.5	5.6	2.5	11	2.2

Cycles 1 and 2 - before seat erosion test

Cycles 3-6 - after seat erosion test

DATA SHEET FOR FUNCTIONAL TEST

TABLE I

EQUIPMENT LIST

H40122: FUNCTIONAL TEST

Item No.	Item	Manufacturer	Model/Part No.	Serial No.	Remarks
1	Test Item	Pacific Valve Co.	3/4-S-17250Y-12K-GL(xxs)		¾" Globe Valve
2	Helium Source				7000 psi
3	Hand Valve	Dragon	31-1	1252	10,000 psi
4	Filter	Western Filter	T8-19310-2		2 Micron (Nominal)
5	Pressure Gage	Ashcroft			0-10,000 psi ± 2% F.S.
6	Regulator	Victor	LR20BB4A4A3	S-6709	0-7,000 psi
7	Pressure Gage	Heise	H 16722R		0-10,000 psi ± 0.1% F.S.
8	Hand Valve	Marsh	1924 FFG		10,000 psi
9	Hand Valve	Grove	47X1C4T	HV 327	6,000 psi
10	Hand Valve	Grove	47X1C4T	HV 878	6,000 psi
11	Graduated Cylinder		0-100 ML		Leakage Measurement
12	Water Tank				For Leakage Measurement
13	Torque Wrench	Snap On Tools	20T125R80		0-600 in-lbs.
14	Hand Valve	Republic	138-4SS		3000 psi
15	Regulator	Kendall	30		0-100 psi
16	Pressure Gage	Heise	H 19623		0-50 psia ± 0.2% F.S.
17	Pressure Gage	Ashcroft			0-15 psig ± 0.25% F.S.
18	Relief Valve	Republic	629XB	RV25	Set @ 100 psig

TABLE II

EQUIPMENT LIST

H40122: SEAT EROSION TEST

Item No.	Item	Manufacturer	Model/Part No.	Serial No.	Remarks
1	Test Item	Pacific Valve Co.	3/4-S-17250Y-12K-GL (xxs)		¾" Globe Valve
2	Gaseous H_2 Source				7000 psi
3	Hand Valve	Robbins	510		10,000 psi
4	Filter	Western Filter	T8-19310-2		2 Micron (Nominal)
5	Regulator	Victor	LR20EB4A4A3	S-6710	0-7000 psi
6	Pressure Gage	Ashcroft	Maxisafe	ME 124131	0-10,000 psi ± 2% F.S.
7A	Pressure Gage	Ashcroft	Maxisafe	ME 124135	0-6,000 psi ± 2% F.S.
8	Pressure Gage	Ashcroft	Maxisafe	ME 124136	0-10,000 psi ± 2% F.S.
9	Check Valve	Republic	428-4ZT-6		
10	Check Valve	Republic	488-4SS-2		
12	Hand Valve	Control Components	MV6004T-P		6,000 psi
13	Hand Valve	Robbins	510		10,000 psi
14	Hand Valve	Robbins	510		10,000 psi
15	Hand Valve	Robbins	510		10,000 psi
18	Hand Valve	Robbins	SSTG250-4T		6,000 psi
19	LPG Flowmeter	Rockwell	CP786669	Positive Displacement	0-2.5 SCFM ± 1% F.S. 10 psi max. op. press.
21	Valve	Annin	1520	G6451	2500 ASA Cylinder Operated

TABLE II (Continued)

Item No.	Item	Manufacturer	Model/Part No.	Serial No.	Remarks
22	Valve	Annin	9420	H1776	2500 ASA Cylinder Operated
23	Pressure Gage	Ashcroft	Duragauge	ME 124670	0-60 psi ± 2% F.S.
25	Thermocouple	Conax	Cu/Cn		± 2%
26	Pyrometer	Gray Instrument Company	E 3048T	13144	± 0.5% Deviation Thermocouple Read Out
27	Gas Pump	Haskel	22920	7110	10,000 psi max. Discharge

FUNCTIONAL TEST FIXTURE SCHEMATIC

MARTIN
DENVER DIVISION

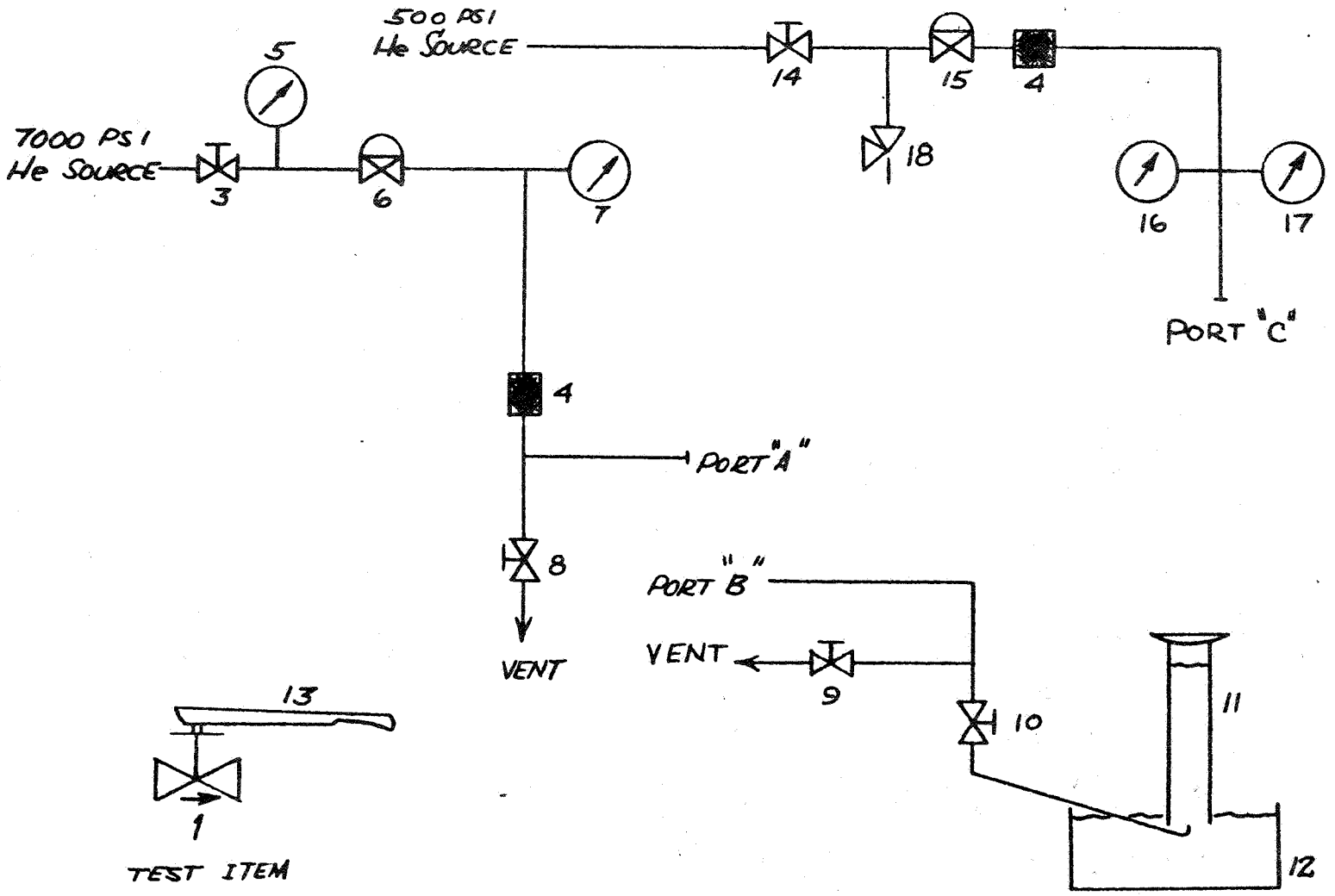


FIGURE 1
H40122

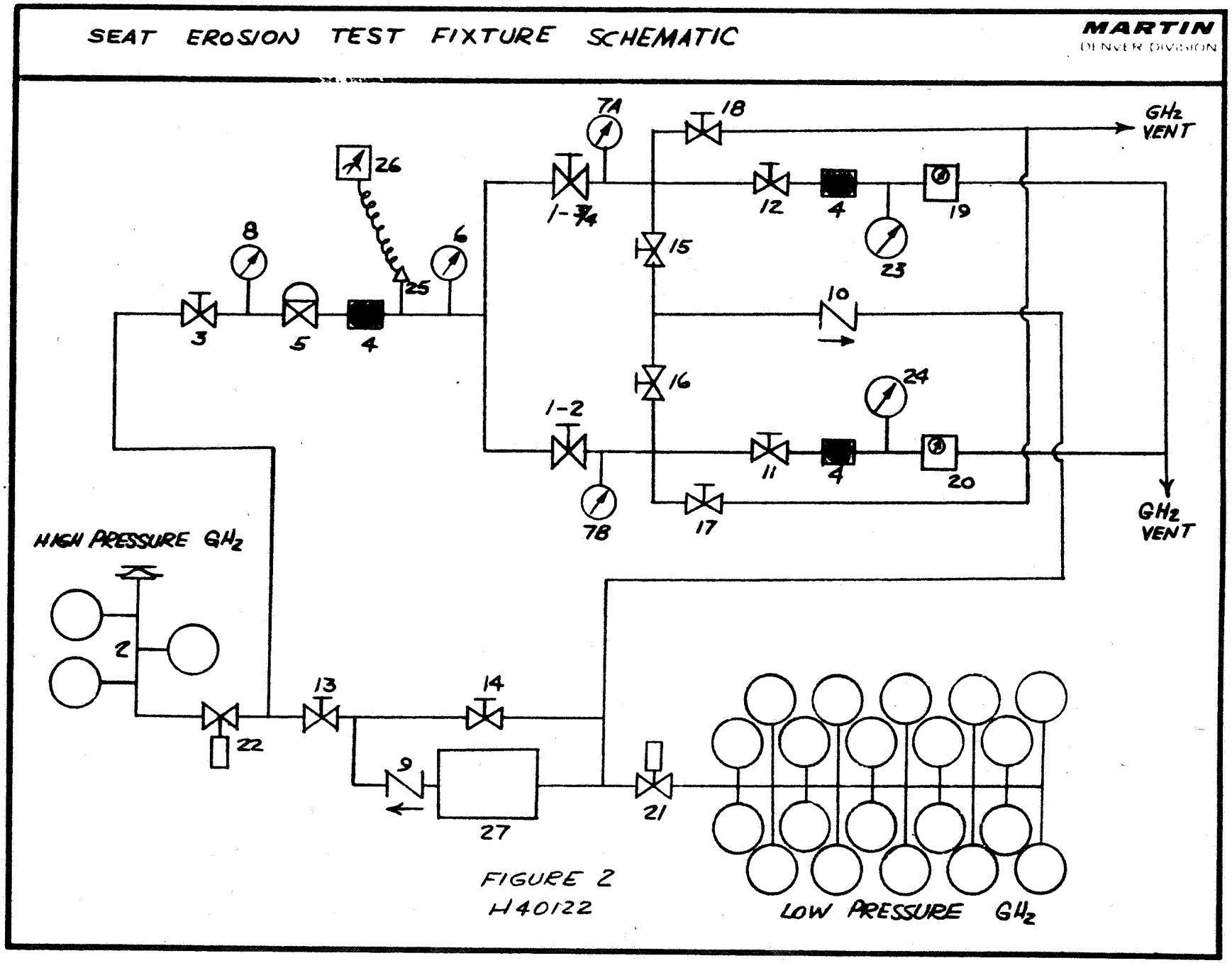
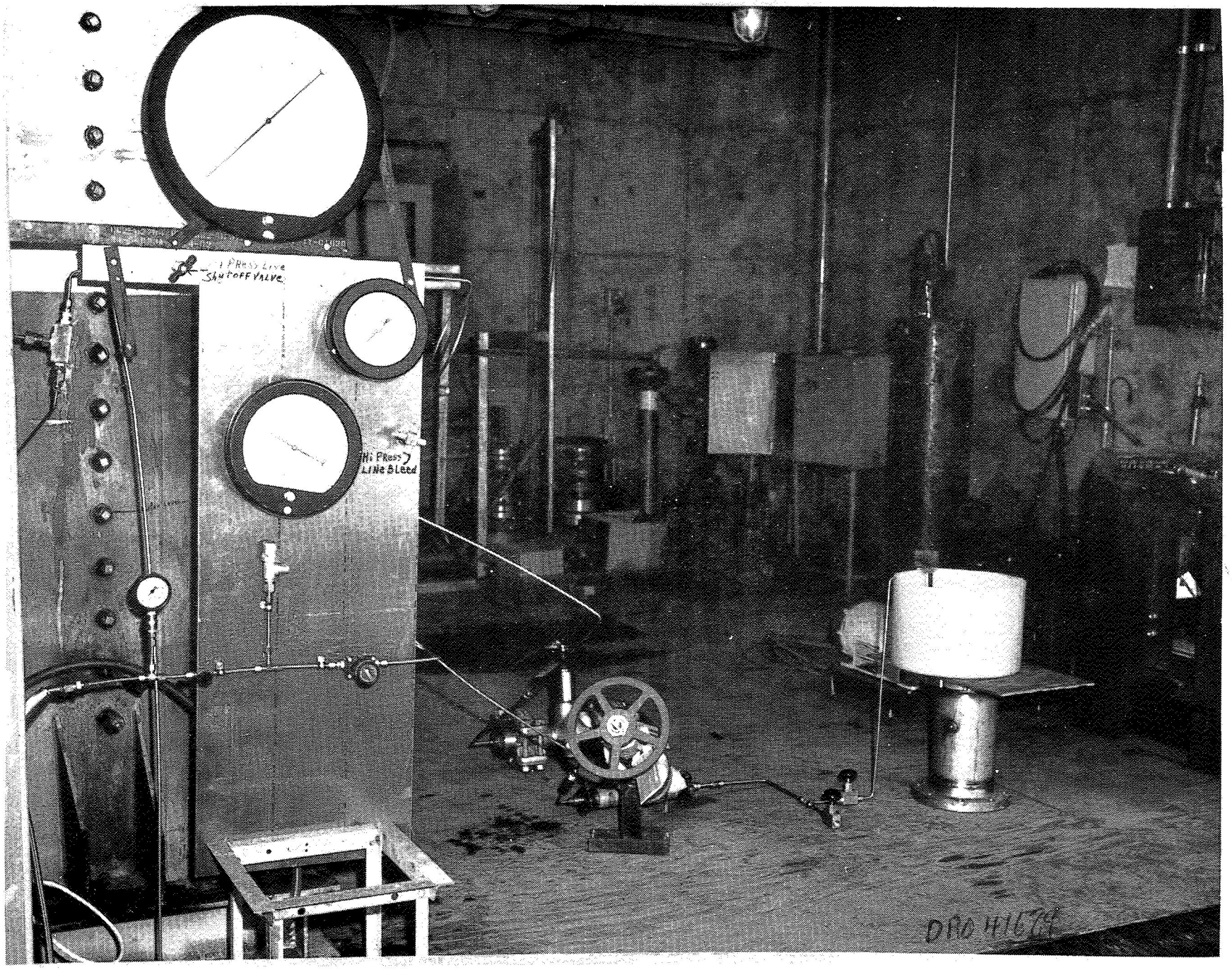
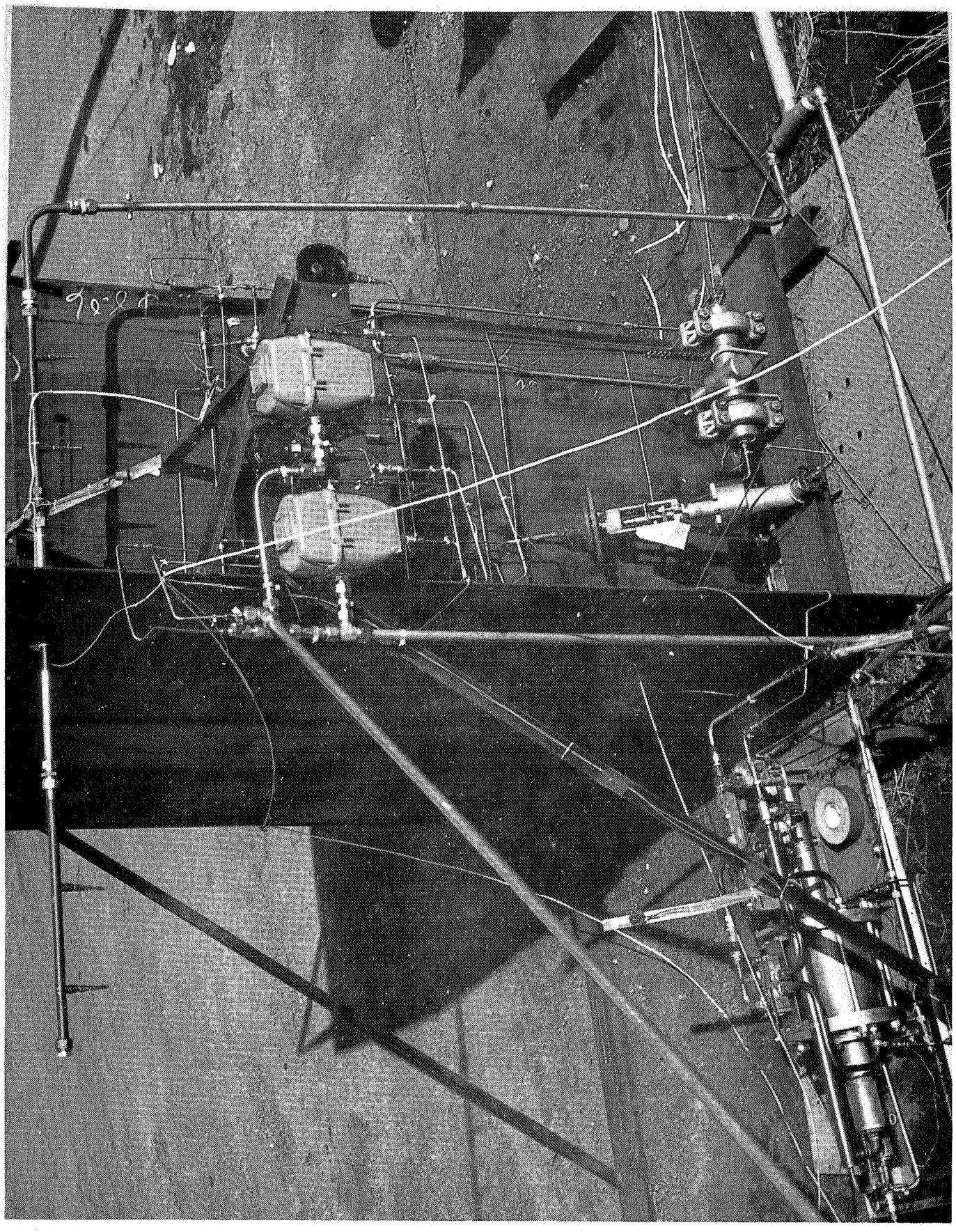
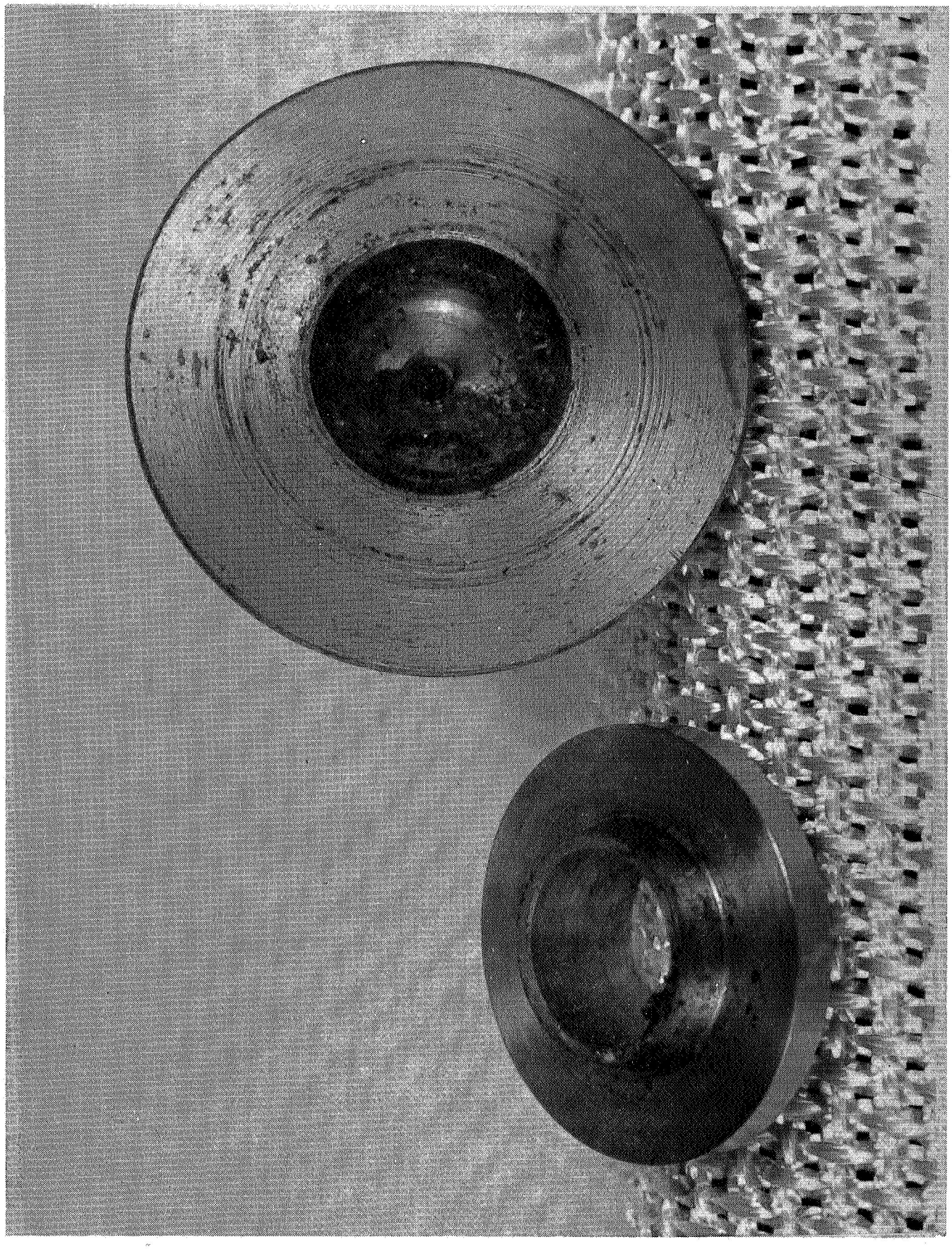
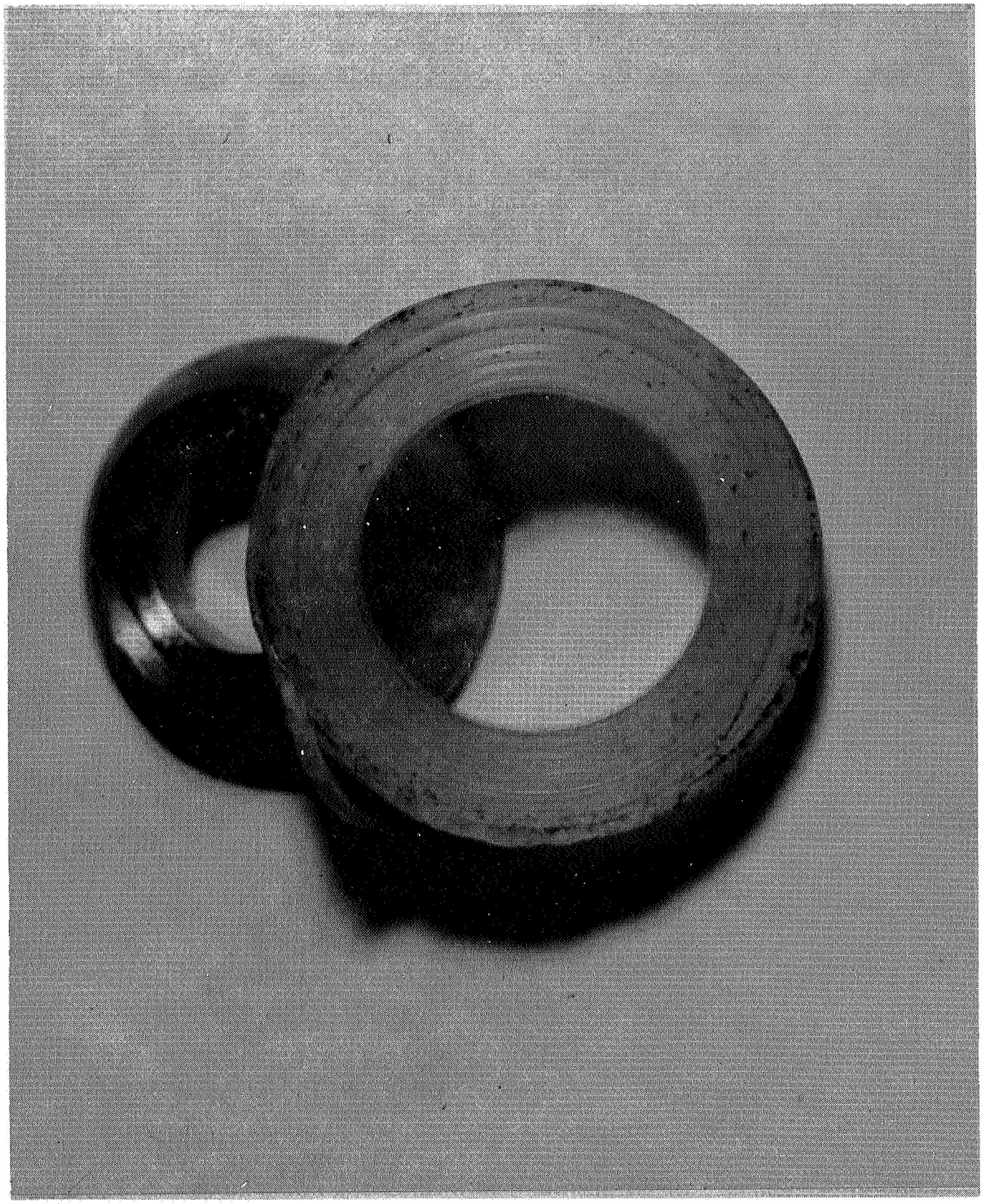


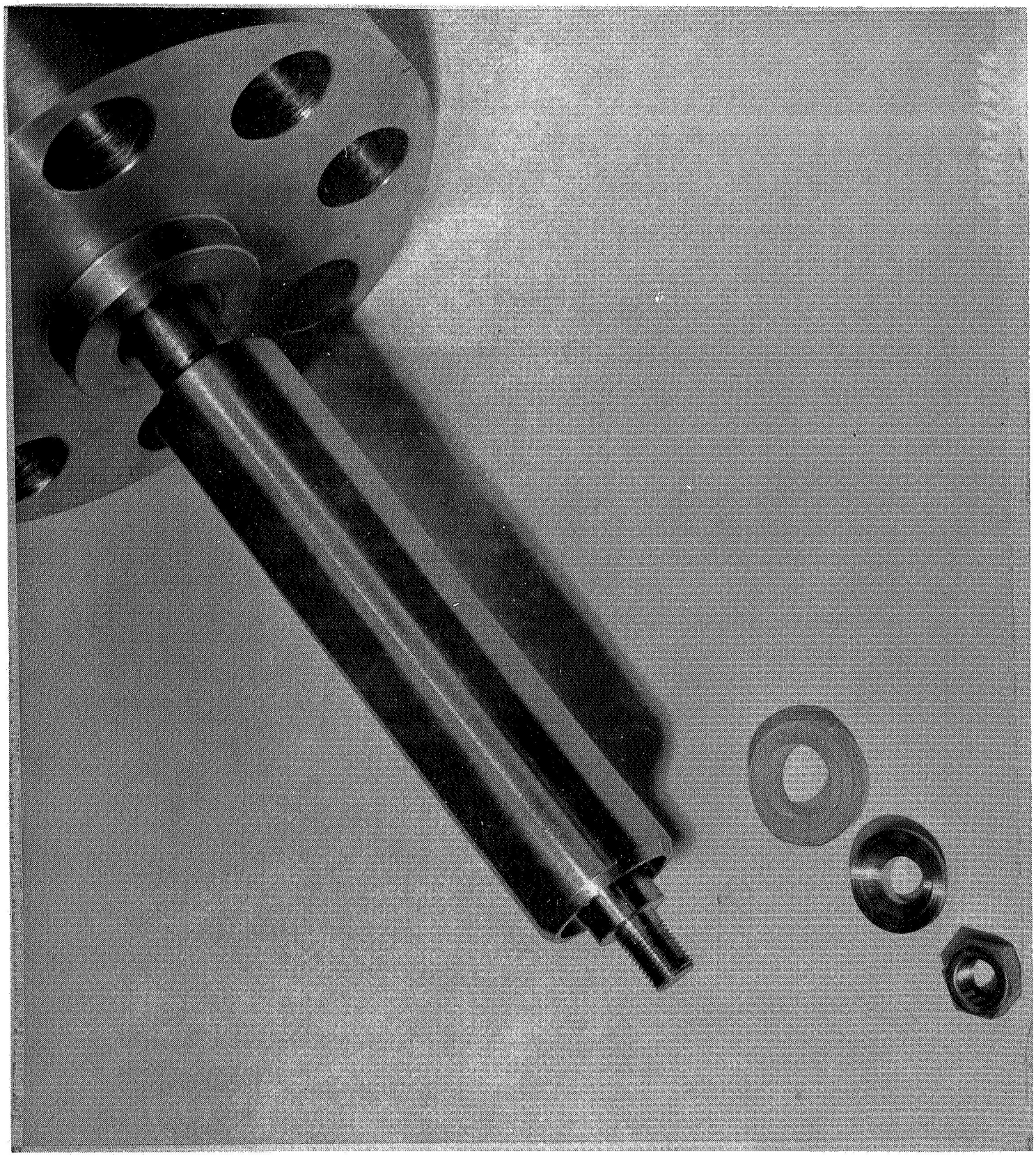
FIGURE 2
H40122

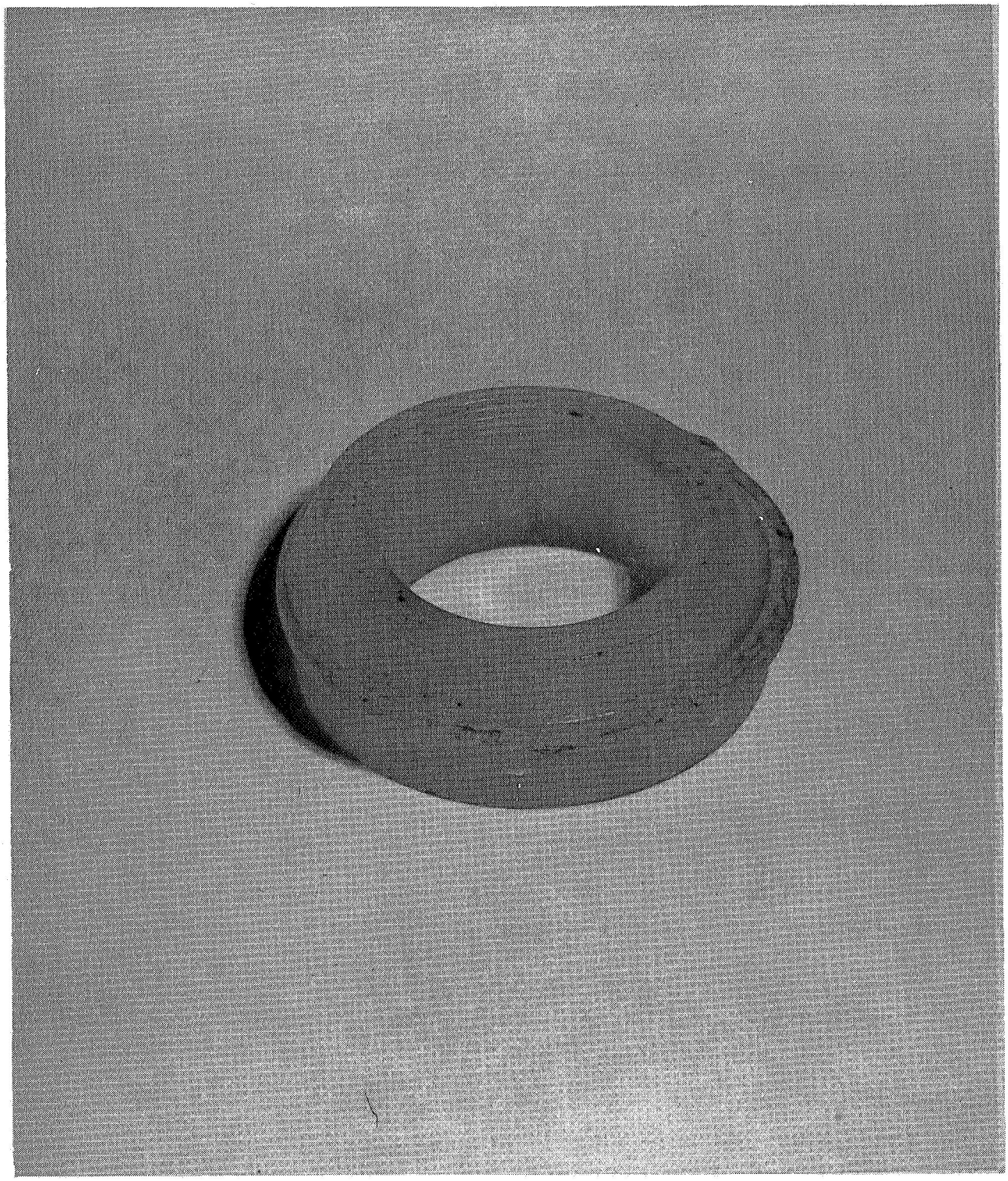

Hi Press
Line Bleed
DNO 41678











APPROVAL

TEST REPORT

FOR

GLOBE VALVE, 3/4-INCH, 6000 PSIG

Pacific Valve Company Part Number 3/4-S-17250Y-12K-GL(XXS)

NASA Drawing Number 75M09618 PGLV-3

SUBMITTED BY:

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Test and Evaluation Section

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